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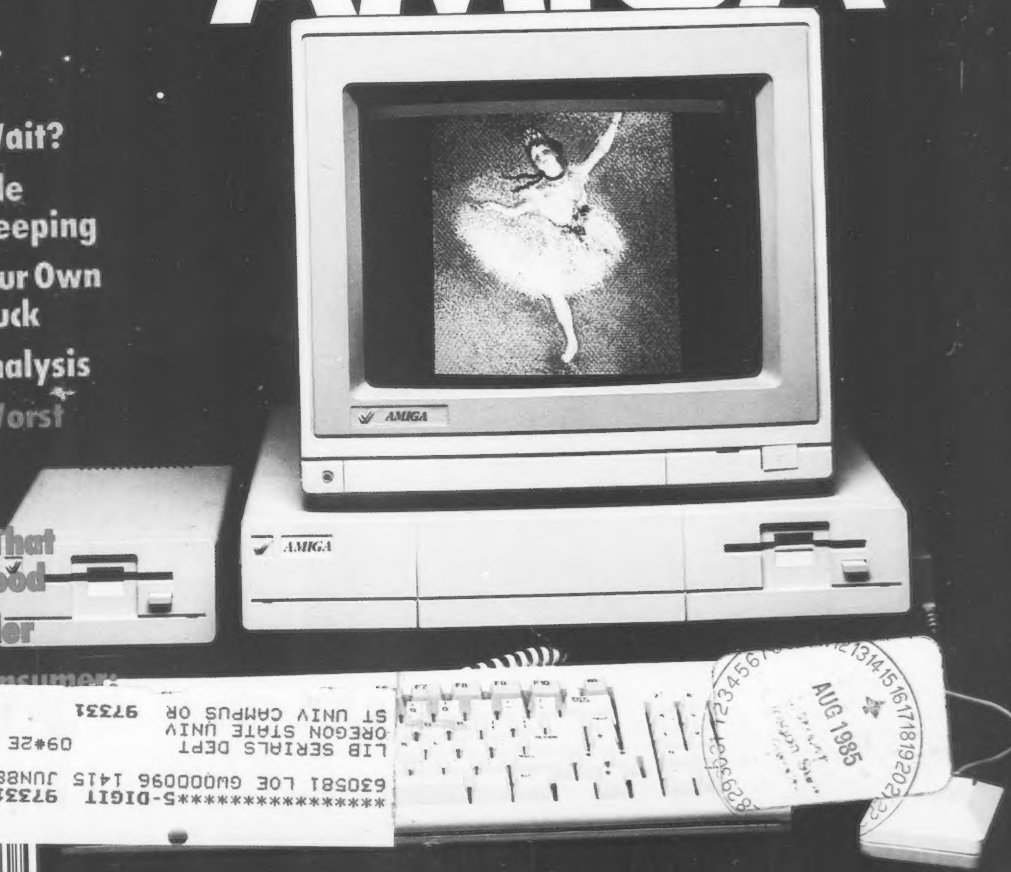

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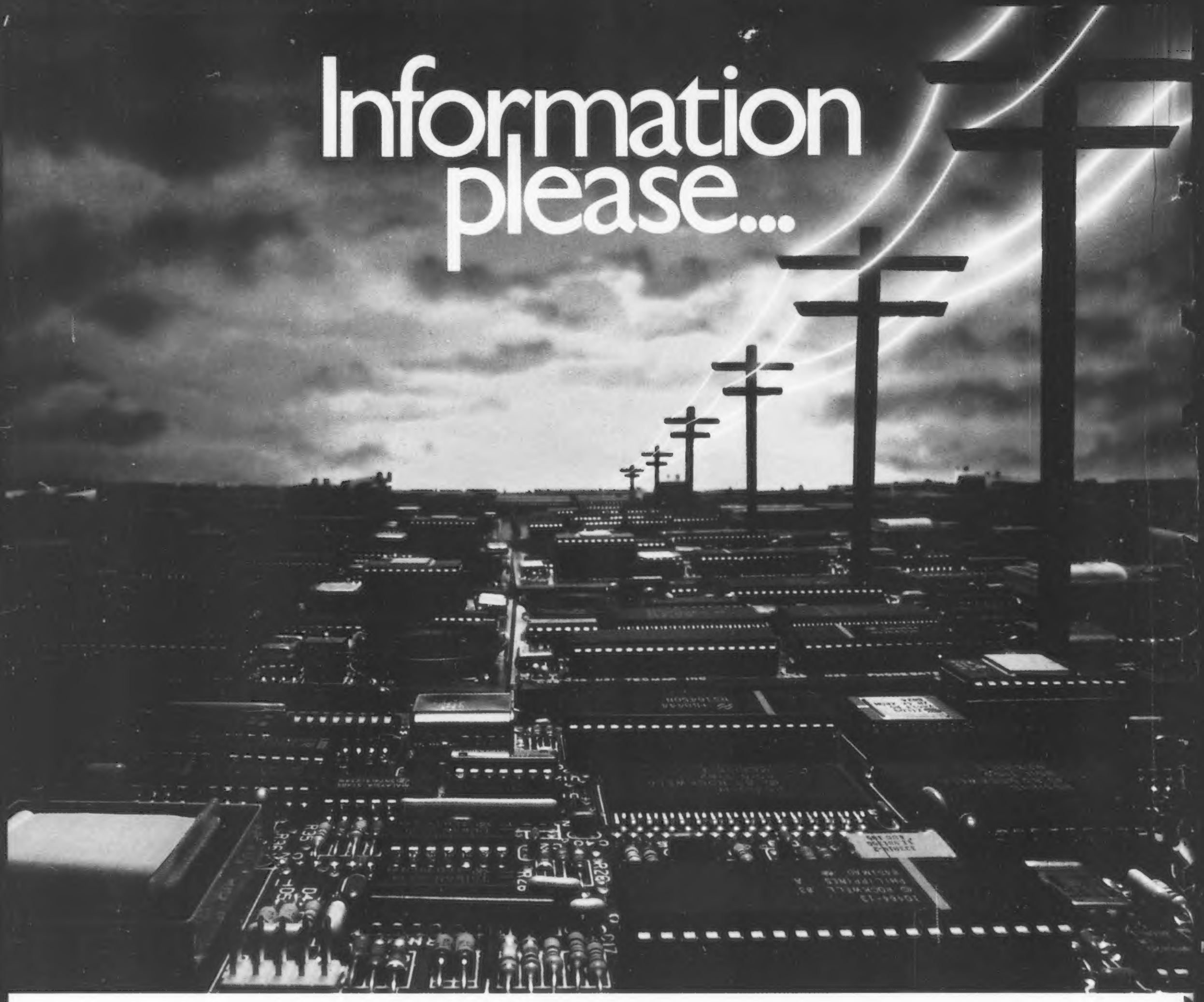
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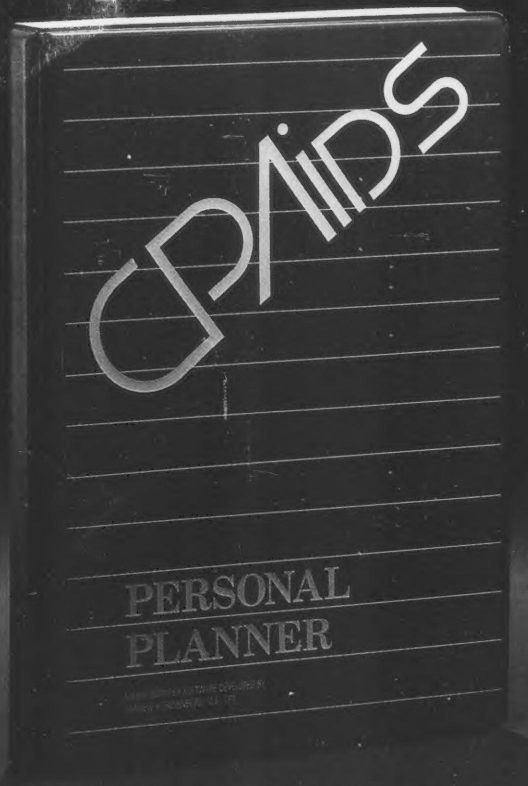

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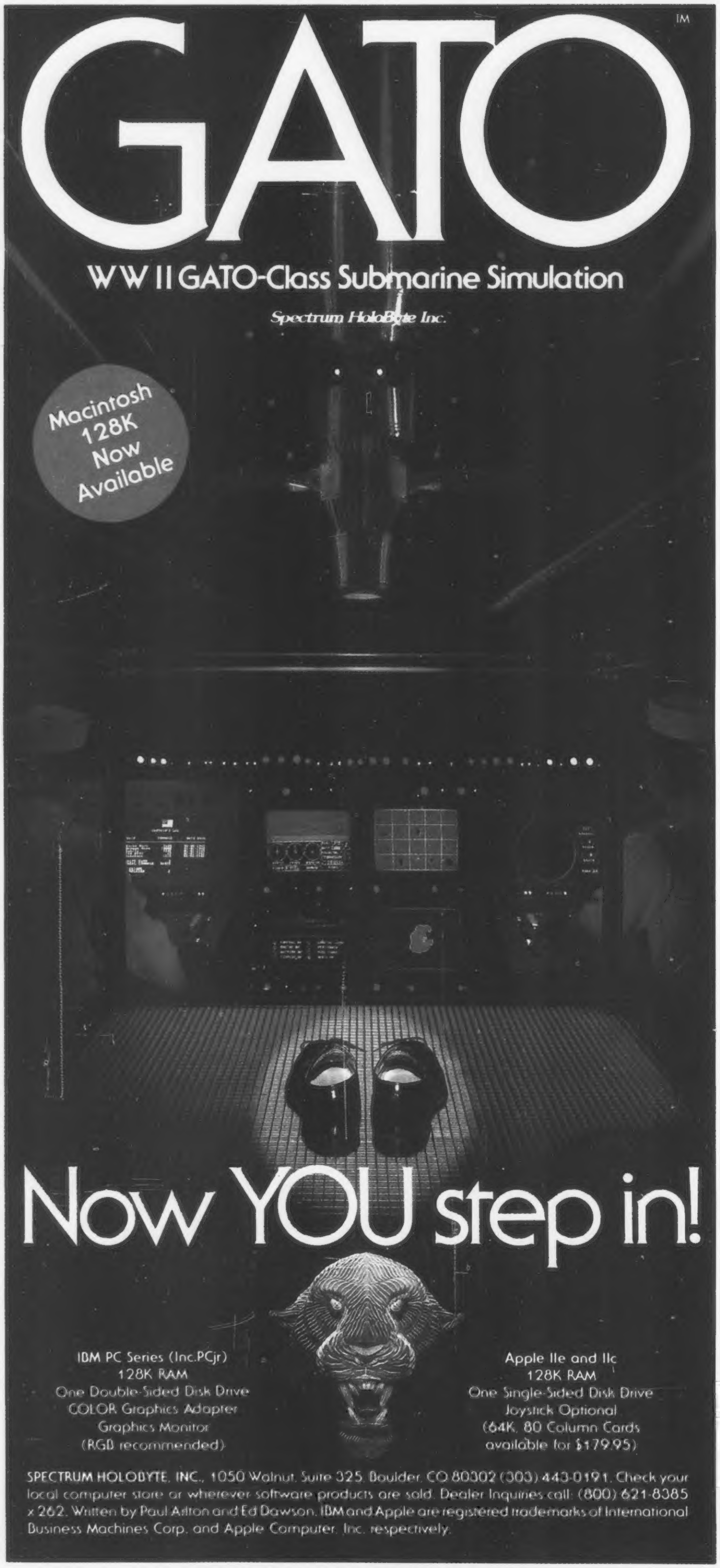

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INPUT/OUTPUT

Benchmark Test Revisited

Dear Editor:

In the July 1984 issue of *Creative Computing* you promised that a more comprehensive benchmark would be forthcoming to replace the existing one. Where is it?

William H. Collins
26 Park Dr.
Mount Kisco, NY 10549

Several analysts spent many hours working out three new benchmark tests. All of them were longer than the original and, upon testing, none gave different or better results. We did find a slightly better way of checking the random number generator, but it requires three separate programs (or subroutines) and is considerably longer for only a marginal improvement.

Thus we decided to stick with our original. As you'll notice in most of our computer reviews, we use it to compare the machine being tested with one or two competitors.

For those of you who missed the original program, it is reproduced below. —DHA

```
10 'Ahl's Simple Benchmark
20 FOR N=1 TO 100: A=N
30 FOR I=1 TO 10
40 A=SQR(A): R=R+RND(1)
50 NEXT I
60 FOR I=1 TO 10
70 A=A^2: R=R+RND(1)
80 NEXT I
90 S=S+A: NEXT N
100 PRINT ABS(1010-S/5)
110 PRINT ABS(1000-R)
```

A Confusion of Sorts

Dear Editor:

In re "A Confusion Of Sorts" by Albert Nijenhuis (June 1985), we thought you might be interested in the following:

In his article Mr. Nijenhuis referred to the controversy regarding the feasibility of trisecting an angle and stated, "Many man-years have been spent trying to disprove that one, and if the debate has ended, it's because interest has waned—not because the problem has been settled in the public's mind."

We conducted a survey which tends to support Mr. Nijenhuis's statement. One hundred attendees at a recent Mets game at Shea Stadium were asked, "Has the statement 'You can't trisect an angle,' been proven to your satisfaction?" The response was:

Yes:	3
No:	1
Don't Care:	96

Interestingly enough, regarding Mr. Nijenhuis's observation, "They say that you can't sort a list of N objects in less than N log N operations," only one member of the surveyed group would admit to having made that statement.

Barry Kornfeld
Stony Clove Computer Center
190 Waverly Pl.
New York, NY 10014

MSX and Spectravideo

Dear Editor:

Upon leafing through my old issues of *Creative Computing*, I had the good fortune to find the article on MSX graphics (Feb. 1984). It pays to keep old issues since one may find, in the future, something pertinent which was not of interest when the magazine was first received.

I recently purchased a Spectravideo 328 which was the machine used to develop your graphics routines. The SV 328 is a discontinued model, and I am searching desperately for peripherals (expander, parallel interface, disk drive), books, and related information.

Will the forthcoming MSX computers from Japan give the SV 328 a new lease on life—or at least provide a source of information?

Richard J. Cunningham
133-50 118 St.
S. Ozone Park, NY 11420

As we note in "Industry Insider" this month, Spectravideo was purchased by its former manufacturing arm, Bondwell Industrial Co. of Hong Kong. Their address in the U.S. is 3300 Seldon Ct., Freemont, CA 94539. I'm not widely optimistic about the prospects of getting an expander box for the 328, as we have been trying to get one for ours for over a year with no success.

We had been hoping that the Japanese would make a commitment to MSX in the U.S., but all current indications are that they are still playing a "wait and see" game. I don't expect to see MSX in the U.S. for at least a year—if at all.—DHA

Computer Loans for the Disabled

Dear Editor:

As Editor of *Re:Able*, a bi-monthly newsletter that deals with the subject of computers and the disabled, I am glad to see articles like Peter Bates' "New Developments in Handicapped Access" (March 1985). I agree that it is important to encourage government funding for computers, but we do not need to wait for the government to respond. Indeed, there are groups that provide equipment for qualifying persons with disabilities.

The Committee On Personal Computers and the Handicapped (COPH-2) has an equipment loan program for its disabled members. The Center for Computer Assistance to the Disabled (C-CAD) also provides computers for people with disabilities.

At *Re:Able* we are working to establish a center for research into applications and a national employment database for disabled individuals with computer skills. The computer can do much to improve the lives of those with disabilities, but we must first get computers into their hands.

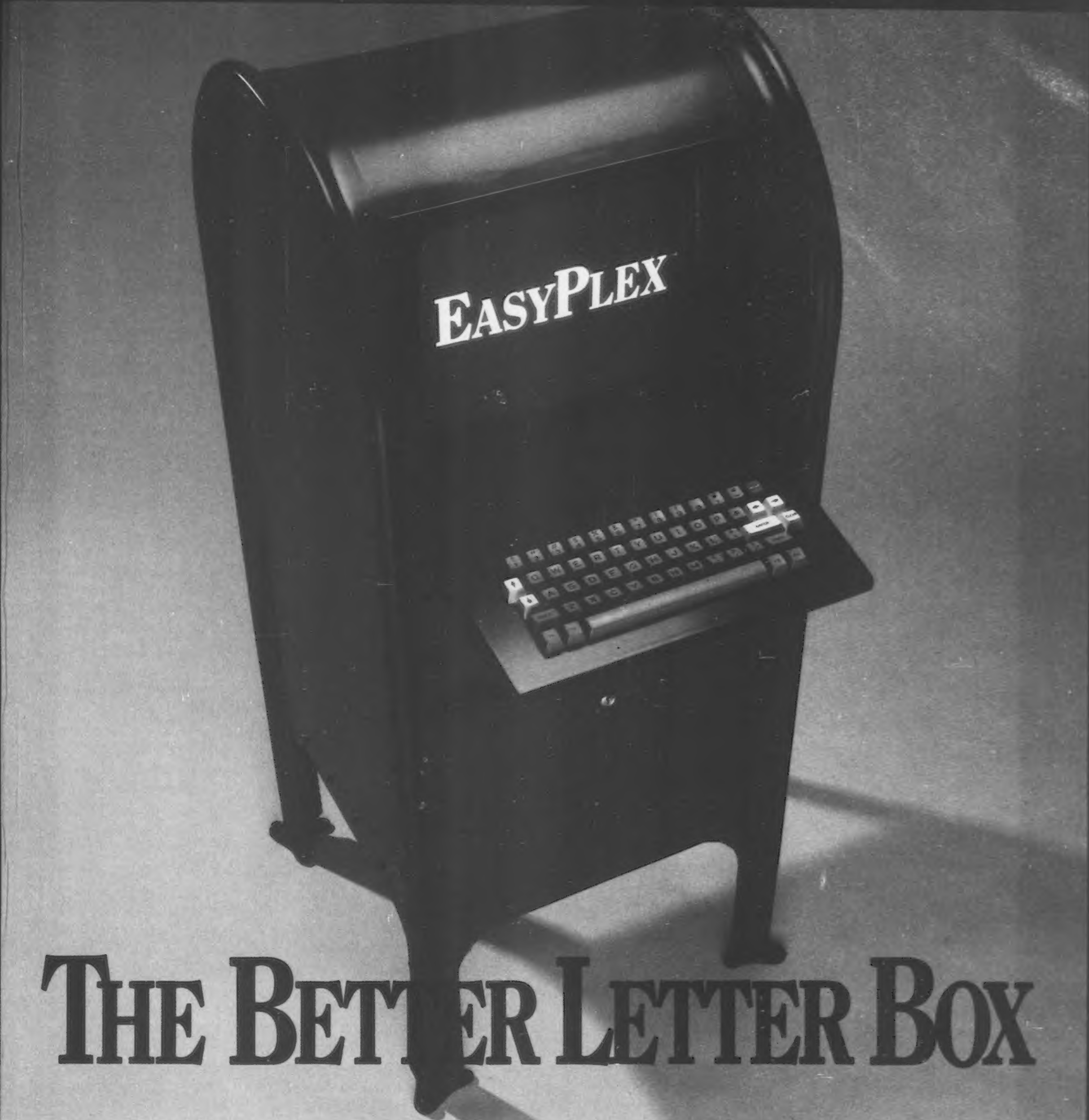
William Kaiser
Editor
Re:Able
P.O. Box 384
Bellflower, CA 90706

NOTICES

Computers and the Disabled

"Computers and the disabled" will be the topic of a conference to be held October 17-19, 1985, at California State University, Northridge.

For more information contact California State University, Northridge, 18111 Nordhoff St., Northridge, CA 91330. (818) 885-2578.



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INDUSTRY INSIDER

David H. Ahl

Not All Doom and Gloom

From practically zero in 1978, the floor space devoted to computers and electronic games at the semi-annual Consumer Electronics Show (CES) hit a peak at the 1983 Winter show. It has been downhill ever since. At the Summer 1985 show, fully one-quarter of the space originally allocated to computer manufacturers was reassigned to pre-recorded video producers.

On the other hand, although the number of exhibitors was down, there was a feeling of guarded optimism in the air. Jim Levy of Activision told me that he felt the inventory pipeline was finally almost empty of the enormous number of software packages ordered on the strength of the wildly optimistic forecasts of 1983-84. Other software manufacturers felt that although retailers had been burned badly, they were smarter for the experience and were now ordering realistic quantities. As a group, the educational software manufacturers were the most optimistic of all, generally feeling that both home and school users were willing to buy quality software.

On the hardware front, Japan, Inc. decided not even to show MSX. Hence, the only MSX machine commercially available in the U.S. is the Hong Kong-made Spectravideo Express. Thus without MSX as a major force, the low end of the market is wide open to the Commodore 64 and 128, Atari XL series, and Tandy Color Computer. And without the specter of a price war on the horizon, the second half of 1985 should be profitable for manufacturers and retailers alike.

On the other hand, the recent *Creative Computing* survey indicates that home consumers are moving up scale in their choice of machines. If only Apple would get off their business kick, they could probably sell gobs of Apple IIs and Macs into the home market. But if Apple abandons the upper end home market, it will be wide open for the Commodore Amiga (look for a $2000 bundled price) and Atari ST series. Following Apple's lead, Atari is now talking about a business market for the ST—fine from a performance standpoint, but ridiculous from a market acceptance standpoint. Another machine that might have some limited potential in the home market is the Laser 3000 from Video Technology. This almost Apple-compatible should sell for $500 or so, but obtaining widespread distribution will be a problem for the company. Another company facing distribution headaches is Amstrad who introduced the CPC1628, a hot seller in Europe.

In peripherals, we were impressed by the many inexpensive printers being shown by companies that had previously eschewed the home market: Epson, C. Itoh, NEC, Star, and others. Also being shown were some really innovative devices: the Soniture Space Pen, a 3-D entry device; Kraft's QuickStick, a joystick for the Macintosh; three computer interfaces to Tomy robots from Computer Magic; and ten robotic/computing kits from Fischer Technik.

So to the home market doomsayers, we can only repeat Mark Twain's immortal words, "The reports of my death are greatly exaggerated."

Improving Educational Software

Back in the mid-70's educational software for microcomputers was limited to translations of programs that had been running on timesharing systems with ASR-33 terminals, i.e., lots of uppercase text scrolling endlessly by. By 1980, educational software had split into two branches: programs written by well-meaning teachers with little or no knowledge of computers and programs written by hot shot programmers with little or no knowledge of pedagogy. Today, those two branches seem to be coming together as better financed (read: larger) companies put together teams of researchers, authors, and programmers under managers who have had experience in the business of education.

That is not to say that all the new educational software from well-known companies is wonderful—it is not—but in general the quality is improving. For example, we were impressed by many of the packages from **Discovery Software**, a World Book subsidiary. In producing these packages, much attention was given to on-going research done by World Book in information delivery and in identifying academic areas in which kids tend be deficient. Discovery released 21 packages in three age ranges, preschool, primary (ages 6-10), and intermediate (ages 10-13).

Random House also released a large selection of packages, mostly featuring licensed characters (the Peanuts gang, Garfield, and Potato Head). We had our doubts about the educational values of the animated Potato Head program, but one new one, *Fix It* (the only one not based on a character) was marvelous. In it you assemble (or fix), with one part or 50, a mechanism designed to get a ball from a discharge chute into a cup.

A similar program using far fewer but more colorful animated parts is *Creative Contraptions* from **Bantam**. You can use up to 12 parts (pulleys, levers, springs, magnets, etc.) to assemble "Rube Goldberg-style" contraptions. As might be expected, Bantam is putting maximum emphasis on their line of interactive fiction. For ages 10 and up, they have released two titles in the Choose Your Own Adventure Series (*Escape* and *The Cave of Time*) and for teens and older, two in the Living Literature Series (*I, Damiano* and *Sherlock Holmes in 'Another Bow'*). Fans of adventure stories will like *The Fourth Protocol* adventure game based on the novel of the same name by Frederick Forsyth.

"Interactive fiction" seems to be the hot category this year. Two years ago these programs were known as adventure games but that didn't have the right ring for educators, so the name of the genre evolved. From **Simon & Schuster** comes *Star Trek: The Kobayashi Alternative* and from **Mindscape** come Stephen King's *The Mist*, *James Bond: A View to A Kill*, and one for the Macintosh,

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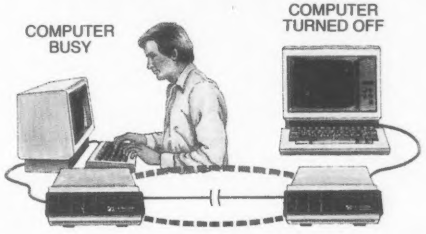

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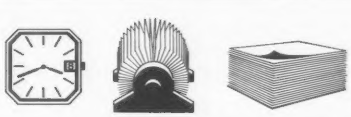
Simple To Use

Our $149 Communications Buffer is a 4 by 6 card that plugs into the ProModem 1200 motherboard. It comes with 2K of CMOS battery-backed memory, expandable to 512K. Part of the memory is used as a dialing directory with the balance reserved for storage. For $99 more, a front panel Alphanumeric Display can be added. These two powerful options can be included at time of purchase or can be installed later.

Does Far More Than Hayes

ProModem 1200 is Hayes compatible but that's where the resemblance ends. Our standard $495 modem includes a real-time clock/calendar. Hayes charges hundreds more for a Smart Modem with a time-base. Nor do they have printer buffering, electronic mail, or security as part of the modem at any price!



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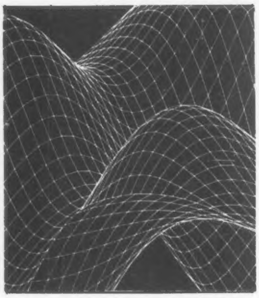
Deja Vu (which Dave Gordon of Datamost felt was the best product at the show).

Another hot category is "write your own story." A new entrant, **Woodbury** has a series of four such programs: *Mystery, Castles & Creatures, Tales of Me,* and *Adventures in Space,* while **Scarborough, Random House**, and others are augmenting existing lines with new titles.



More Woes, Some Bright Spots

Unlucky 1300. It was only a matter of time before the slowdown in end user sales worked its way through the pipeline to the chip makers. Hoping to avoid a third quarter loss, **Intel** reduced its workforce by about 1300 employees on July 1. Most of the cuts were in manufacturing and support. **Apple** also fired 1300 workers and closed its Carrollton, TX plant and one of its two plants in Ireland. It also put up for sale its Garden Grove plant. The third maker to lay off 1300 workers was **Data General**. In addition, the company closed all its plants for two weeks in July. Even with these moves, DG expects a third quarter loss. **Hewlett-Packard** also asked all of its employees to take three extra days off in July.

These companies aren't alone. **ComputerLand Corp.** announced a 10% reduction in staff, **Storage Technology** announced an employee cut of 500, and **Advanced Micro Devices** said it will place employees on a four-day work week.

But amid the gloom were a few bright notes. **Ashton-Tate** announced that first quarter revenue was up 114% over the same quarter a year earlier. And **Apricot, Inc.** announced an 82% increase in annual sales and a 129% gain in profits compared to a year earlier.

New Computers at CES

In a sense, there weren't any truly new computers at CES. Yes, **Atari** had a few prototype 130ST and 520ST models but they had been shown at Hannover Fair and reported on earlier. While **Commodore** had production 128s, they were waiting until the end of July to publicly unveil the Amiga. In a back corner of their booth, Commodore was testing U.S. waters with their Model 900 Unix-compatible business computer; it seems unlikely that it will see the light of day in the U.S. simply because Commodore's channels of distribution are inappropriate for such a machine.

Amstrad, a U.K. company which brought out its first computer (CPC464) in June 1984, quickly captured a large market share in Europe. Trying to follow one success with another, in the U.S. market they have introduced the CPC6128, a Z80-based machine with 128K and built-in 3" (not 3.5") floppy disk drive. Bundled with an 80-column monochrome monitor, CP/M, *WordStar,* and Basic, the system will sell for $699.

Video Technology was showing a redesigned Laser 3000. Redesigned so as not to infringe on Apple patents, the Laser 3000 is now 90% Apple compatible according to marketing manager David Gish. The machine has 64K, built-in 32K Microsoft Basic in ROM, 80-column display, double-density graphics (560 x 192 pixels) with six colors, parallel printer interface, RS-232 port, RGB and composite video output, and a four-channel sound generator. Bundled with a single disk drive and Artsci's *Magic Window II, Magic Memory,* and *Magicalc,* the machine will sell for about $500.

Spectravideo, now owned by Bondwell Industrial Co. of Hong Kong, showed the Express, an MSX computer with 64K and built-in 3.5" floppy disk drive. It will retail for $595. The company also showed the Bondwell 2, a lap-size portable with 64K, built-in 3.5" drive, 25 line LCD display, parallel and serial ports, and I/O expansion slot (for a modem). With CP/M, *WordStar, CalcStar, DataStar, Mailmerge,* and *ReportStar,* the computer will sell for $999.

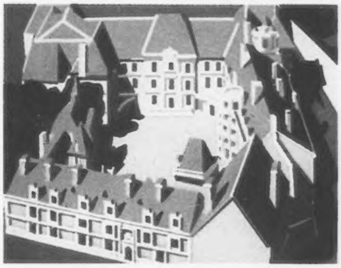
Random Bits

At CES John Williams of **Sierra On-Line** gave us a sneak preview of a one-write check writing/accounting system for the Mac. One-write is a favorite system among millions of small businesses and this Sierra package should make the transistion to computerized accounting easy and foolproof . . . Diversification is the watchword at **Broderbund** these days. Watch for *Fantavision,* a special effects/animation generator for the Apple; *Science Toolkit,* a combination of hardware and software that turns your Apple into a science lab; and *Captain Goodnight and the Islands of Fear,* a feature-length arcade adventure game . . . **MicroProse** has added several new simulations to their line: *Gunship* simulates the AH-64 Apache attack helicopter; *Silent Service* is a submarine simulation; and *Kennedy Approach* is an air traffic control simulator with computer-generated speech.

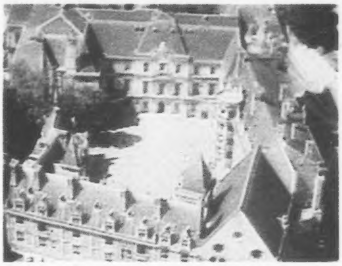
Mike Katz (R), president of Epyx and Jim Levy, president of Activision were happy and optimistic at CES.

Want to guard your modem from voltage spikes on the phone line? Both **Networx** and **Panamax** introduced telephone line protective devices . . . **Okidata** unveiled the Model 120 printer for the C64. This 80-column dot addressable unit prints at 120 cps and sells for just $269 . . . **Smith Corona** introduced an interface for its electric typewriters that lets them double as computer printers . . . **Epson** showed the HS-80, a nifty portable ink jet printer measuring just 13" x 4.5" x 3".

Activision showed an early version of a computer game design kit which allows a user to select various actions, backgrounds, characters, sound effects, and music for his own game. President Jim Levy also told me of the discovery of little human-like beings which are believed to be living inside of every computer. The company is trying to lure them into hospitable environments so their habits can be studied further . . . Two early programmers from Activision, Alan Miller and Bob Whitehead, broke off and founded a new company, **Accolade, Inc.**; no products have been produced yet . . . Silliest product at CES? The Microtech flea collar for "small or moderate-sized pets with short hair." It repels fleas with a high-frequency inaudible sound—as long as the batteries last, that is.



Salamandre videodisc system uses both live footage and computer generated images.



Interactive Videodiscs in France

As mentioned last month in Industry Insider, many French software companies are also looking into developing interactive videodisc programming.

Today, however, most videodisc applications in France are for companies or government agencies. One of the most interesting—that would surely sell well to consumers and schools—has the unlikely name of Salamandre. It was produced by ODA/Havas with financing from the Octet Agency of the Ministry of Culture.

This disk provides information—in French or English—on the 19 chateaus of the Loire region. You can get detailed information on the history, architecture, and museum of each chateau. In addition, the disk contains information on restaurants, wines, and the economy of each town on the chateau route. All of this information can be accessed in a variety of ways—touch screen menu, "landing" a simulated helicopter anywhere on the route, or typing in a word (name of a king, architectural feature, wine, etc.) The historical information is fascinating; for example, there is an interactive description of costumes of the 18th century. Paintings can be studied by zooming in on specific details, and, if you feel competitive, an optional quiz section will test your knowledge of any of the information on the disc. ■

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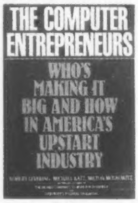
BOOK REVIEWS

Databases, integrated packages, and odds and ends/Russ Lockwood

The Computer Entrepreneurs by Robert Levering, Michael Katz, and Milton Moscowitz. New American Library. Hardcover, 481 pages, $19.95


THE COMPUTER ENTREPRENEURS
WHO'S MAKING IT BIG AND HOW IN AMERICA'S UPSTART INDUSTRY

The Computer Entrepreneurs provides short profiles on 65 pioneers of the microcomputer revolution. Each profile chronicles the rise of a company and offers glimpses into the background, motivations, and dreams of its founding father.

Divided into seven sections—machine makers, software wizards, innard engineers, shopkeepers, information moguls, industry gurus, and the rising sun—almost all the famous, and infamous, pioneers are here: Bushnell, Jobs, Tramiel, Millard, McKenna, Adams, Hayes, Carlston, Osborne, and other household names.

Based on interviews and supplemented with good old fashioned research, the book keeps a light touch throughout. Not surprisingly, most of the entrepreneurs have several things in common: humble backgrounds, workaholic tendencies, divorces, and colossal egos.

The Computer Entrepreneur makes for fascinating reading. If you are interested in the founders of microcomputerdom, pick up this book—one profile and you will be hooked.

The Book of Adventure Games by Kim Schuette. Continental Arrays, 11223 S. Hindry Ave., Los Angeles, CA 90045. Softcover, 341 pages, $19.95

THE BOOK OF ADVENTURE GAMES
By Kim Schuette

Sooner or later, every adventurer will be baffled by a puzzle, lost in a maze, and just completely stymied. Usually, this happens at 3:00 a.m., a time when most sane people are in bed. But the lure of the treasure and the challenge of the encounter spur them on—until utter frustration sets in.

If you have been in this situation, by all means take a close look at *The Book of Adventure Games*. In its third printing, the book details the secrets of 77 adventure games, including hints, maps, and treasure listings.

All your favorites are here, from *Original Adventure* through Infocom's *Zork III*. The clues seem accurate and provide enough information to set you on course.

Of course, recent adventure games like Infocom's *Wishbringer*, the Telarium line, the Synapse Electronic Novel line, and the Bantam Living Literature line are not in the book. However, if you need help with a pre-1984 adventure game, *The Book of Adventure Games* just might be your salvation.

Tools for Thought by Howard Rheingold. Simon and Schuster. Hardcover, 335 pages, $17.95

HOWARD RHEINGOLD
TOOLS FOR THOUGHT
THE PEOPLE & IDEAS BEHIND THE NEXT COMPUTER REVOLUTION

Tools for Thought is subtitled "the people and ideas behind the next computer revolution." Nothing could be further from the truth. Instead of a glimpse into the future, a vision of things to come, or a look at current research in the computer field, this book is yet another history of the computer.

This is not to say it is a bad history; quite the contrary. The book is well researched and traces the development of computing devices over the last 100 years. It focuses a little more on the people, from Charles Babbage to Alan Turing through Ted Nelson, than other books. While not Pulitzer prizewinning prose, *Tools for Thought* plods along at a steady pace, and if you have not read too many other similar books, history and eccentric inventors make for interesting reading.

With few exceptions, *Tools for Thought* deals strictly with the history of the computer. Those with expectations of a window on the next computer revolution will be disappointed, but those with expectations of a well-researched history will emerge enlightened.

The Basic Handbook by David Lien. CompuSoft Publishing, 535 Broadway, El Cajon, CA 92021. Softcover, 740 pages, $24.95

3rd Edition
THE BASIC HANDBOOK
An Encyclopedia of the BASIC Computer Language
by DAVID A. LIEN

This book is subtitled "encyclopedia of the Basic computer language" and it certainly fulfills its claim. No other Basic reference guide comes close to *The Basic Handbook*. It covers just about every Basic dialect known to microcomputerdom, including the brand new True Basic by Kemeny and Kurtz.

Lien lists each Basic command and proceeds to dissect it. He starts with a definition of the command, moves into an explanation of the format, lists a short Basic program showing the command in use, shows a sample run of the program, and then discusses how different dialects use the command. He provides alternate words and spellings, substitute subroutines to emulate a command if your dialect of Basic does not have that particular command, and cross references to complementary commands. Several appendices, including explanations of program conversions from one Basic dialect to another, trigonometry functions and applications, and special graphics and sound statements, round out the book.

For convenience, and to save space, Lien targets the "mainline core of Basic" commands shared by most computers. This means that the 350 main entries in the book actually hold approximately 500 total commands. Top priority was assigned to documenting the language rather than machine-specific dialects and also helping programmers solve problems of incompatibility because of differences in the dialects.

According to recent survey results, most *Creative Computing* readers program in Basic. For you, *The Basic Handbook*, now in its third edition, offers a cornucopia of programming insight. Take a good look at this reference guide, it is likely to be the last "encyclopedia" you will ever need.

BOOK BRIEFS

Databases

Using dBase III by Edward Jones. McGraw-Hill. Softcover, 262 pages, $17.95

This text is an introduction to databases in general and *dBase III* in particular. It covers the fundamentals of database operation and design, and includes an introduction to programming in the *dBase III* language. it also shows you how to link *dBase III* to other popular programs and how to use *dBase III* utility programs.—*JD*

101 Questions About dBase II by Julie Ing and Bill Fletcher. Prentice-Hall. Softcover, 220 pages, $16.95

This compilation of *dBase II* questions and answers covers program installation, database files, data exchange, report writing, programming techniques, and more. Specific examples are included.

A User's Guide to dBase II by James T. Perry and Robert F. McJunkins. Reston Publishing. Softcover, 268 pages, $16.95

This more conventional, tutorial-style treatise on *dBase II* helps novices create and operate a database.

Using the IBM PC: Pfs:File/Pfs:Report by W. Robert Crowley. CBS Computer Books. Softcover, 154 pages, $19.45

Pfs:File/Report hardly requires a book, but if you feel you need one, this book will start you out quickly and painlessly.

Database for the IBM PC by Sandra L. Emerson and Marcy Darnovsky. Addison-Wesley Publishing. Softcover, 311 pages, $14.95

This buyer's guide reviews 12 database management systems in depth and another 21 in chart form. The book explains what a database is, how one operates, and how to evaluate your requirements.

Creating the Perfect Database Using DB Master by Trish McClelland. Scott Foresman & Co. Softcover, 244 pages, $17.95

The book, a comprehensive tutorial on *DB Master* from Stoneware Inc., is for beginners, for only beginners believe in perfect databases.

The dBase II Cash Manager by Paul W. Heiser and Inge D. Pinckney. Prentice-Hall. Softcover, 248 pages, $15.95

The pairing of a programmer and a CPA with an MBA creates a database to handle the financial affairs of small businesses. For those who do not want to type in the programs, a $95 disk can be ordered.

Integrated Packages

The Framework Book by David Kruglinski. Osborne/McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710. Softcover, 293 pages, $17.95

This tutorial shows users already familiar with *Framework* how to develop expert skills.

The Symphony Book by Edward M. Baras. Osborne/McGraw-Hill. Softcover, 270 pages, $19.95

This tutorial guides users through *Symphony* operations.

Software Master for pfs: by Ted Leonsis. Warner Books. Softcover, 220 pages, $14.95

This book reads like one long press release—how terrific the *pfs* series is and testimonial after testimonial from people who use the programs. You might pick up an idea here and there, but probably not.

Framework: On the Job Applications by Clark Fishback, Ted Reindal, and Charles Pilgrim. Ashton-Tate Publishing, 10150 W. Jefferson Blvd., Culver City, CA 90230. Softcover, 270 pages, $19.95

If you need *Framework* for various applications—personnel, marketing, sales, receivables, manufacturing, or budgeting—you can type in the FRED programming modules from the book or send away for a $16 disk.

The Power of Appleworks by Robert E. Williams. Prentice-Hall. Softcover, 231 pages, $19.95

This fine introduction to *Appleworks* for the beginner provides step-by-step instructions to get up and running in the shortest possible time.

Odds & Ends

Computer Genealogy by Paul A. Andereck and Richard A. Pence. Ancestry Inc., P.O. Box 476, Salt Lake City, UT 84110. Softcover, 280 pages, $12.95

This starts as a neophyte's guide to computers, complete with advice on price, an explanation of what a computer is, and a discussion of software. Once through this, *Computer Genealogy* delves into choosing and using specific genealogical programs, including an overview of the popular *Family Roots* package by Quinsept. It also lists many genealogical sources. Anyone interested in genealogy should pick up this book—it is well worth the price.

Personal Computer: A New Tool for Ministers by Russell H. Dilday, Jr. Broadman Press, 127 Ninth Ave N., Nashville, TN 37234. Softcover, 188 pages, $8.95

As president of Southwestern Baptist Theological Seminary, Dilday provides a minister's eye view of using computers for preaching, counseling, records, church management, and more. Some of the more creative examples include an electronic prayer guide for Muslims, document database for Talmudic scholars, computerized catechisms for Catholics using the title In Christ Jesus: Testing Program and Computerized Inventory, and 2000 Yoga exercises for a Sikh sect.

A Field Guide to Personal Computers for Bird Watchers and Other Naturalists by Edward M. Muir. Prentice-Hall. Softcover, 207 pages, $9.95

Although much of this book is an introduction to computers, bird watchers will have a field day pairing their hobby with the power of a microcomputer.

A Guide to Computer Careers by Donald D. Spencer. MacMillan. Softcover, 147 pages, $8.95

This book provides an introduction to computer technology and the variety of employment opportunities available within the field. It defines job titles and includes salaries. Ignore the awful cover that pictures a lost executive, amazed secretary, and hapless PCjr with Chiclet keyboard—this can be a valuable book for teenagers.

Computerspace by James Wagenvoord. Putnam Publishing, 200 Madison Ave., New York, NY 10016. Softcover, 128 pages, $9.95

If you are looking to create the proper home environment for you and your computer, take a look at this book. It is loaded with photos and covers lighting details, ergonomics, and aesthetic design. ■

IN REAL TIME

Weather to be/Bertha B. Kogut

When Grant Zehr, a physician in Bloomington, IL, wants to see the weather in Bloomington, CA, he displays real time weather satellite images of the continental U.S. using the Commodore Vic 20 in his workshop. When these images show severe storms in California, Robert Green and his colleagues at a National Oceanic and Atmospheric Administration (NOAA) research center in Colorado can analyze them in color on an IBM PC XT. And if the storms are especially severe, California communities will receive real time warnings of flash floods from a microcomputer-based flood alert system.

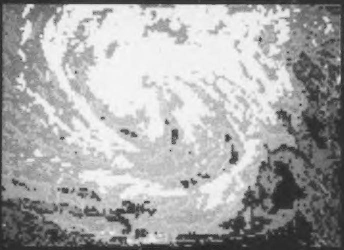
This scenario demonstrates the expanding role microcomputers are playing in environmental research and operations. This role was spotlighted recently at the International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology. The conference, sponsored by the American Meteorological Society, brought environmental scientists together to discuss new developments in hardware and software for interactive data processing in their discipline. One theme running through many of the papers and hardware displays was that improvements in the computational power of microcomputers make it feasible to design inexpensive scientific data analysis systems based on off-the-shelf personal computers. Two important applications of these new capabilities are the interactive display and analysis of meteorological and geophysical images, and the management of environmental databases using microcomputers.

The most colorful use of micros in environmental research is in the analysis of images from earth-orbiting spacecraft. NASA and NOAA operate a small constellation of satellites which view the earth and provide regular data on weather patterns, severe storms, snow cover, and agricultural conditions. Finding the best way to use this imagery in operational weather forecasts and earth resources assessment is an important research topic, and microcomputers are new tools for quickly and inexpensively analyzing this remotely sensed data.

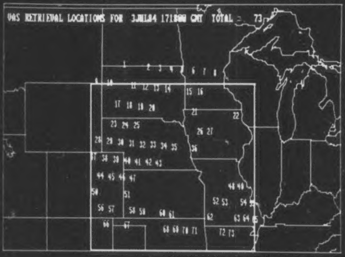
In a joint effort between the Space Science and Engineering Center at the University of Wisconsin and NOAA's National Environmental Satellite, Data, and Informations Service (NESDIS), a system based on a personal computer was developed to display and analyze satellite imagery. The VAS PC workstation is built around an IBM PC XT with enhanced color graphics hardware, and displays images of severe storms and other atmospheric processes seen by NOAA's GOES weather satellite. Color images of hurricanes and tornado producing thunderstorms are routinely generated by the system, which also loops through successive images to show the movement of the storms.

A similar system developed for the NESDIS Satellite Applications Laboratory (SAL) by Research and Data Systems, Inc. of Lanham, MD, displays and processes images from a sensor aboard NASA's Nimbus-7 satellite which penetrates clouds to provide all weather observations. Based on a DEC PDP 11/03,

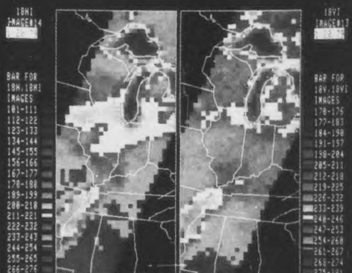
A GOES satellite infrared image of cloud formations over the Eastern U.S. Sixteen-color level image at 100 lines by 160 pixels resolution from the IBM PC XT of the VAS PC workstation.



A GOES satellite visible image of Hurricane Josephine (Oct. 12, 1984). Sixteen-color level image at 100 lines by 160 pixels resolution from the IBM PC XT of the VAS PC workstation.



Collection sites for GOES satellite data in the North Central U.S. A black and white graphics map from the 200 lines by 320 pixels resolution graphics mode of the IBM PC XT of the VAS PC workstation.



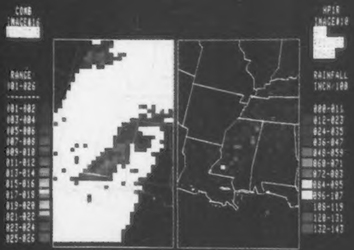
Color images of surface and atmospheric phenomena in the Central U.S. as seen from NASA's Nimbus-7 satellite. Colder temperatures of the Great Lakes show as blue, and flooded land along the Mississippi River is the dull yellow area at the Arkansas, Tennessee, Alabama borders.

The most colorful use of micros in environmental research is in the analysis of images from earth-orbiting spacecraft.

the SAL Image Manipulation and Processing System (IMPS) generates color maps of rainfall, snow cover, and lake ice which are normally obscured from spacecraft by clouds.

Commercial suppliers of weather information to the media, agriculture, and aviation also turn to microcomputers to provide a low-cost flexible method to receive and display current weather imagery. The satellite-based weather maps many Americans see on their evening news are frequently downloaded directly from the satellite to an Apple or IBM PC at the local TV station.

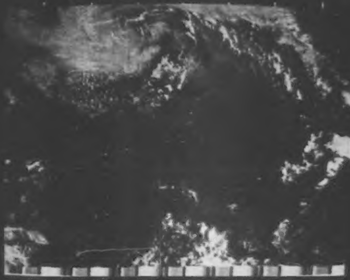
While some micros share the spotlight on the late night news, others toil at less glamorous, but equally important, environmental tasks. Since 1976 the California-Nevada River Forecast Center of the National Weather Service has employed a community focused system using off-the-shelf micros to warn of the largest weather-related killer in the United States: the flash flood. In the ALERT System (Automated Local Evaluation in Real Time) micros serve as base stations for a network of flood sensors which transmit to local communities river and stream conditions indicating the onset of flooding. Many local agencies also want to use the system to monitor fire hazard conditions, air pollution, water conservation, and high wind. Mobile ALERT units combining a TRS-80 Model 100 with a Bearcat radio scanner are being developed for emergency situations like wildfires and toxic chemical releases.



Nimbus-7 SMMR images of rain (left) compared with surface measurements of rain (right) from the NESDIS IMPS.

A closeup of a satellite image of a hurricane from the Zephyr Corporation IBM PC system used for commercial television weather.

A GOES satellite image of Western Hemisphere weather from a Zephyr Corporation IBM PC system used for commercial television weather.



A TIROS-N visible image of clouds over the Eastern U.S. from Grant Zehr's Vic 20 based satellite image display system. The southern part of Lake Michigan and Lake Erie can be seen as the dark areas in the top center of the image below the large swirl of clouds.

In Canada microcomputers are at both ends of a data collection and analysis system for that country's Atmospheric Environment Service. Data collection platforms with built-in microprocessors gather weather data from inaccessible sites and radio information to overhead satellites. On the other end, personal computers control the quality of incoming data and automate the nighttime long distance telephone dialing into meteorological databases.

Scientists dealing with man-made environmental problems also find that personal computers have enough speed, memory, and storage to meet many of their day to day needs. At the Radian Corporation in California, microcomputers use commercial spreadsheet and database software to model the dispersion of atmospheric pollutants and manage databases of meteorological and hazardous materials information.

The low cost and wide availability of personal computers make them particularly attractive to educators and hobbyists. Systems like the VAS PC workstation are used as teaching aids at Purdue University and the University of Oklahoma. And, as mentioned above, a very inexpensive system for displaying real time satellite imagery was developed by Grant Zehr, a computer and amateur radio hobbyist. This system, built around a Commodore Vic 20, collects automatic picture transmissions from NOAA's Tiros-N satellites and produces enhanced displays of the weather over the U.S.

The teaching potential of such computer systems has impressed educators like Fred Decker of the U.S. Department of Education. He notes that "We have to project systems like this into the classroom to let students see examples of the applications of physics and engineering to everyday problems."

It seems clear that while students, scientists, and computer hobbyists of the future may not be able to do anything about the weather, they will be able to interact with it much more personally. ■

Undercover Consumer Joins the Club

Betsy Staples

Software Club
Undercover Consumer
CLUB

The Undercover Consumer was eating breakfast. As she nibbled on her English muffin, she flipped casually through the latest packet of coupons and incredible discount offers addressed to the occupant of her house. Pausing in mid-chew, she flipped back a few cards. There it was—between the coupon offering 25¢ off a box of new improved cat treats and the order form for the genuine vinyl all-in-one-billfold-changepurse-checkbook-calculator-notepad—an advertisement and application for a computer software club.

"Maybe Coleco was right," she thought. "Maybe personal computers are a mass market item—what could be more mass market than a mailing addressed to Occupant?"

Closer inspection revealed a promise to save members big bucks on popular software titles—certainly a laudable objective. The only thing that bothered her was the name: Budget Computer Softwares Club. How could anyone possessing even a rudimentary familiarity with the computer world pluralize "software"?

"Maybe they don't have a rudimentary familiarity with the computer world," she thought. "Maybe these people don't know what they are doing. Maybe their motives are less than pure." She decided to check it out.

She detached the "membership application" and mailed it that very day. Much to her disappointment, nothing happened. Several months passed with no communication from her fellow club members. Then she received a crudely mimeographed letter and a list of software prices. No mention was made of ordering the software.

About two months passed. She received a letter from the president of the company stating that they could no longer afford to "extend credit" to club members and that to remain a member of the club she would have to send him the number of one of her credit cards. Here she drew the line; not even for the sake of investigative reporting would she turn her credit card over to an organization that was sounding shadier by the minute. She did nothing.

Then one day a package arrived at her door—COD. Her curiosity piqued, she paid the $41.20 and received a copy of Infocom's *Deadline*. $41.20! Some discount—she had seen the package in a local computer store for $29.95. And she already had *Deadline* anyway, having purchased it more than three years ago when it was first released. So she returned the package unopened with a cover letter explaining that she had not requested it and asking for a refund. She was not surprised when the refund was not forthcoming.

She then called the New York State Consumer Affairs office and was referred to the local Better Business Bureau. The BBB said they had had no complaints about the company.

Several phone calls to the Softwares Club finally elicited a refund check—a happy ending, but no story for UC. Well not quite. A few weeks after depositing the refund check, it was returned as uncollectable. Calls to the Club's former telephone number are now answered with a number change recording. The new number is answered by a woman who claims no knowledge of the organization, but says that she has received many calls for the Club, including several from consumer protection agencies.

Undercover Consumer has filed a complaint with postal authorities, but is not foolish enough to expect to see her $41.20 again. She is just just thankful that her losses were limited and wonders what manner of charges might have been added to the credit card accounts of less wary souls who forwarded their credit card numbers to an outfit that didn't know enough about the business to give their company a credible name.

The moral of the story? Well it could be that software clubs are bad or that people who can't spell are not to be trusted. But this episode is really just an illustration in a much larger lesson: Computers (and software) are not yet mass market products. Expect problems if you deal with companies who treat them as such.

Once you go beyond plugging in the computer and connecting the monitor and external power supply, the chances are you will need help of some sort. User-friendly is not a term that applies to getting any computer system or software package up and running.

If you are a novice (and maybe even if you are not) remember that support from a human being is worth its weight in icons. Buy from companies whose reputations you can check and who agree to answer questions *after* they have pocketed your money. ■

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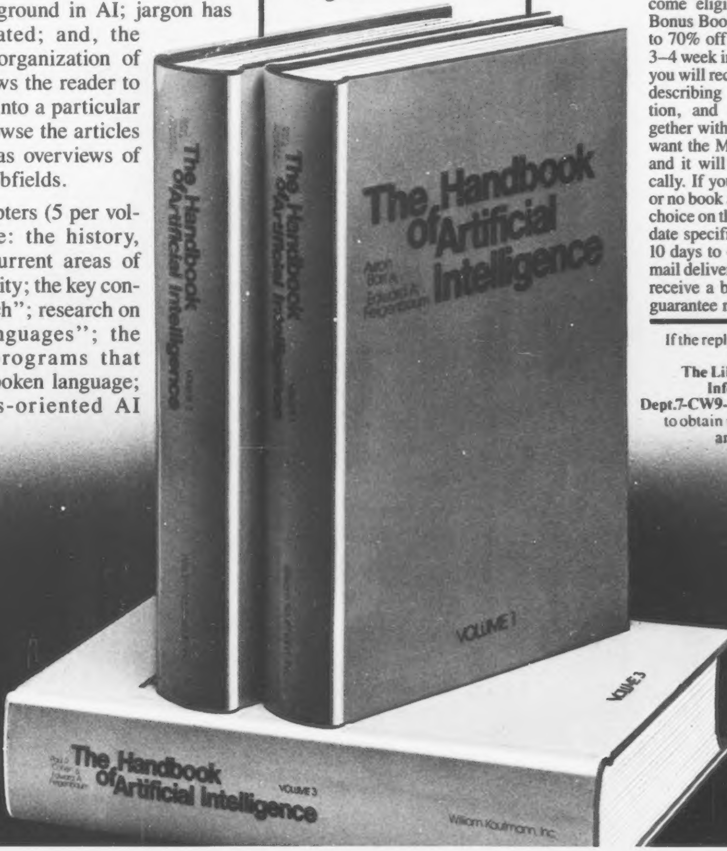
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CIRCLE 115 ON READER SERVICE CARD

RECREATIONAL COMPUTING

Persistent and n-persistent numbers/**Michael W. Ecker**

A while back, Ripley's *Believe It Or Not* published an interesting "fact" about a certain many-digited number. Upon investigation, this "fact" proves to be no fact at all. But it does raise some intriguing questions, and, with a little computer play or math, we can get into this month's challenges.

Let's start with an example. Consider the number 5882352941176470. Notice that each of the ten digits appears at least once. Suppose we now multiply this number by 1, or 2, or by 3, or 4, or . . . (and so on). Does each of the ten digits appear at least once in the product?

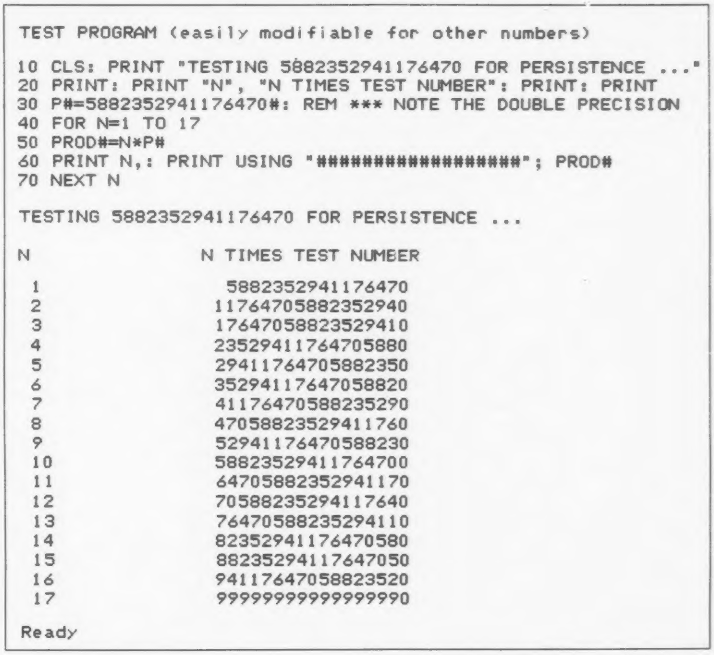
The program in the listing will answer this question—barely. In general, note that one potential difficulty in proceeding is the lack of computer precision for handling so many digits. You would therefore need, for still bigger numbers, to break the big number up—technically, using the *distributive property*—and multiply each "part" by your 2 (or 3, or 4, whichever you were doing). Then you reassemble the results. Such an ultraprecision multiplication program would allow you to test even larger numbers by taking the digits and creating strings, doing arithmetic on each digit, and then printing out the string representing the product.

Now type in and run the program using the large number above. Notice that for quite a few integers, 1, 2, 3, 4, . . . the product in question does contain at least one of each digit. This is somewhat fascinating—and encouraging.

But then the pattern is lost as you suddenly get an answer consisting of a string of 9's followed by a final 0. This is somewhat discouraging.

Let's get back to Ripley's and its error. It said: take any natural number (1, 2, 3, . . . ad infinitum) and multiply it by a specific, special number. The resulting product—regardless of which multiplier is used—allegedly contains at least one of each of the ten digits 0 through 9. They call this special number a *persistent number*.

If there were such a number, it would have to have at least ten digits, because it times 1 would have to have at least one of each digit. In fact, no such number could possibly exist. I tell you this right away so that you don't waste fruitless hours searching for a persistent number.



```
TEST PROGRAM (easily modifiable for other numbers)

10 CLS: PRINT "TESTING 5882352941176470 FOR PERSISTENCE ..."
20 PRINT: PRINT "N", "N TIMES TEST NUMBER": PRINT: PRINT
30 P#=5882352941176470#: REM *** NOTE THE DOUBLE PRECISION
40 FOR N=1 TO 17
50 PROD#=N*P#
60 PRINT N,: PRINT USING "##################"; PROD#
70 NEXT N

TESTING 5882352941176470 FOR PERSISTENCE ...

N              N TIMES TEST NUMBER

 1               5882352941176470
 2              11764705882352940
 3              17647058823529410
 4              23529411764705880
 5              29411764705882350
 6              35294117647058820
 7              41176470588235290
 8              47058823529411760
 9              52941176470588230
 10             58823529411764700
 11             64705882352941170
 12             70588235294117640
 13             76470588235294110
 14             82352941176470580
 15             88235294117647050
 16             94117647058823520
 17             99999999999999990

Ready
```

This is precisely the error made in Ripley's *Believe It Or Not*—so don't believe it. Rather than offer or outline a mathematical proof that no persistent number exists, we can experiment with the program by modifying it. We still would like a multiprecision multiplication program, and I hope to have one in an upcoming issue. I also located one in *Computers in Mathematics: A Sourcebook for Ideas*, edited by our own David H. Ahl and available through *Creative Computing*. This is a nice book to have anyway!

The results can never be conclusive when you just test many examples, but they will be more down to earth. Please try it to persuade yourself. For readers who wish more certainty and to see an elegant mathematical proof, please send me two quarters and a self-addressed, stamped envelope. Indicate that it is for the explanation as to why a persistent number cannot possibly exist.

N-persistence

Okay, so persistence is a dead issue. Can we modify this to salvage something interesting? In a word, yes. We saw that the number I provided earlier has a "partial persistence" property, using only the multipliers 1 through 16. We could say that the number 5882352941176470 is 16-persistent (but not 17-persistent). This is what I did in *Crux Mathematicorum*, a Canadian mathematics problem solving journal, just a few years ago. I defined a natural number as being n-persistent if it is true that the number itself times any one of 1, 2, . . . , n (that is, up to n) yields a product containing each digit at least once.

I haven't told you how I cooked up the special 16-persistent number above. There is an elegant connection of this to the question of certain kinds of prime numbers, but space considerations require that I defer that association—at least until next month. The question before you is: For which values of n do n persistent numbers exist? When we go into this association more, we'll also get into how to discover such a number in the first place.

Time to go again. I invite everybody to try the challenges: come up with your own solutions and your own problems. If I use your ideas, your role will be acknowledged in this column. You may write to me directly at 129 Carol Dr., Clarks Summit, PA 18411.

Until next month, happy recreational computing! ■

Dr. Michael W. Ecker is Associate Professor of Mathematics and Computer Science at the University of Scranton in Scranton, PA.

TRY THIS!

Explosion in paradise: Can you keep the population of a desert island under control?

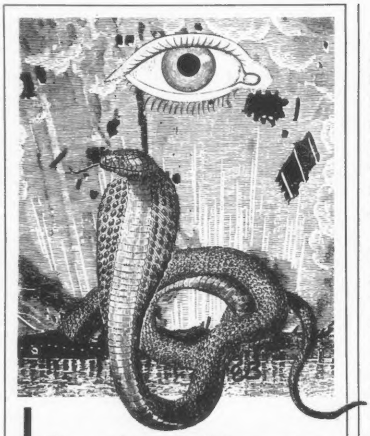
Edward H. Carlson

Imagine being cast away on a deserted Polynesian isle with an attractive companion. Warm climate, refreshing cool sea showers, food within reach on mango trees, and swimming in the lagoon—what a paradise! But remember to bring your computer and solar batteries because you will have some calculations to do.

Soon tiny foot prints scuff the beach sand alongside those of you and your mate. In the fullness of time, grandchildren and finally a whole island of descendents appears. The idyllic tropical island becomes more and more like the real world we inhabit and must cope with. Before things get out of hand, enter the program Island (Listing 1) in your computer, and figure out what the population explosion will be like, given various scenarios.

The program assumes a less fanciful situation than a loaf of breadfruit, a jug of palm wine, and thou. Eleven couples arrive on the island and set up housekeeping. (Why 11? Just because a population of 22 fits the computer screen nicely.) We choose an extreme age distribution—all the castaways are 20 years old. Running the program with this "spike" age distribution shows the tendency of future generations to spread out in age range, eventually attaining a "mature" profile somewhere between "rectangular" and "triangular." More later.

The program was written on an IBM PC with an 80-column green screen monitor, but can be adapted to other computers and to 40 column displays. The program calculates populations down to fractions of a person, but displays results as integers. Fractional people are included so you can scale up the results to large populations. If you truly want to do small populations, put INT( ) functions in as appropriate, and add RND( ) functions, so that nothing is certain—not even death or the consequences of love.



Like a cobra which hypnotizes its prey, the current world population explosion paralyzes our institutions.

Assumptions

The Island program makes two sets of assumptions, one about the death rate at various ages, and another about birth rates. Have fun with this program by altering these assumptions and seeing what happens.

The death rate is set by the function FND( ) in line 2115 and has three parts. A constant term (currently a tenth percent) represents death by accident, occurring with equal probability at any age. A term proportional to one over age squared is largest at young ages and so represents infant mortality. The first few years of a child's life are unusually hazardous. Finally, a term proportional to the quantity age-to-a-power increases mortality sharply for the older folk. (This topic is getting more than a little morbid, and I apologize for that. Just be thankful that I am not also talking about taxes.)

The death rates I have chosen are more typical of a modern society with advanced health care and sanitary measures than of a primitive society on a remote and lonely island. Make other assumptions in the function FND( ) if you wish. Especially, try higher infant death rates and higher constant rates to model the effects of epidemics or an accident-prone life style.

Birth rates are governed less by biological facts than by personal and social attitudes. In the program as listed, custom prevents nubile females from marriage until the age of 20, and childbearing ceases at age 36 (implemented by the FOR statement of line 232. The simplist birth rate function (FNB of line 2120) has the ladies give birth with equal probability each year until they are 36 years old.

Many other attitudes and practices about family size are possible, and most have been tried in one human society or another. I give some other birth rate functions as REMs in lines 2121 to 2124. Try them out, making your own modifications in the numerical values and functional forms. For example, line 2123 shows a birth rate that is decreased if too many old folk are tottering around. Line 2124 decreases birth rate when a gaggle of year old babies is squalling. Improve on this idea by adding an array FS( ) to hold the average family size in each age cohort—letting the parents decide on an optimum family size. The effects of such feedback loops are further explained in the book by the Weinbergs [1].

National policy also affects birth rates. Given some kind of retirement program, parents do not need many children to provide for their old age. A warlike nation (like Nazi Germany) needing young men for cannon fodder or one attempting to extend its cultural influence in the world (like France under de Gaulle) may foster high birth rates. A nation that feels natural resource pressures (scarcity of coal, oil, minerals, farm land), crowding of its population into giant cities, or environmental damage (acid rain, smog, contaminated water), may induce its people to slow or stop population growth (like China and India).

Attitudes in individual families also affect birth rates. Affluent societies tend to have relatively low birth rates, typically from 2.1 to 2.8 children per mother, apparently because children are costly to raise and families would rather spend their income on "quality of life" goods and services—homes, cars, education, vacations, eating out, nice clothes.

Population Profiles

All these decisions yield different profiles for population versus age. A mature, affluent, healthy population has a "rectangular" distribution and zero growth rate. Infants grow up with little probability of death until old age, so the population vs. age graph stays nearly constant until approaching 70 years. Rapidly growing populations have a triangular shaped graph—lots of children. For zero population growth with high birth and death rates, the shape is also triangular. War and economic roller coasters make for wiggly graphs (like the United States).

Like a cobra which hypnotizes its prey, the current world population explosion paralyzes our institutions. Throughout most of human existence, population growth rates were near zero. Since the start of recorded history (about 5000 years ago), growth has been quite moderate—for example, about 0.1% per year (for a doubling time of 700 years). As sanitation and modern medicine improved, death rates fell to a very low level and population growth rose to high levels—as much as 2% world wide in the 1970's, and currently about 1.5%. These numbers may not sound very large, but 2% gives a population doubling time of 35 years. So the population would quadruple in the lifetime of each of us, or increase ten-fold over the combined life spans of you and your grandchildren.

Here is a rule of thumb for calculating doubling times in any kind of growth problem: Simply divide 70 by the percentage growth rate to get the doubling time. Seventy divided by 2% per year gives a 35-year doubling time. (If you are familiar with exponentials and with natural logarithms, you may recognize where the rule comes from—remember that the natural log of 2 is 0.693.)

Now adjust your Island program to have a growth rate of 2%, change the initial population to 5 billion people (the present world population) and let it run an hour or so. You will find that in about 500 or 600 years, the world population would reach 5 trillion. I say *would*, because it is very unlikey that this will really happen. Five trillion is the number

Listing 1. Island program.

```
1 GOTO 2000: ======================= ISLAND ====================================
2 REM file name:ISLAND              disk name:C3                    E. H. Carlson
100 REM --------------------- calculate new population -------------------------
205 P1=TP:TP=0:B=0                      :REM set totals for later sums
210 FOR A=100 TO 1 STEP -1              :REM calc. population of each cohort
212 D=P(A-1)*FND(A)                     :REM deaths in cohort
214 TD=TD+D                             :REM death in population
216 P=P(A-1)-D                          :REM new pop. in each cohort
217 IF P<0 THEN P=0                     :REM can't have a negative population
220 P(A)=P                              :REM store new population in array
225 TP=TP+P                             :REM add to get total population
226 IF A=45 THEN PA=TP                  :REM population of the aged
227 NEXT A
232 FOR A=20 TO 36                      :REM birthing years of females
234 B=B+P(A)*FNB(A):NEXT A:B1=B         :REM add up births of mothers age A
236 P(0)=B:TP=TP+B                      :REM store # babies born
250 GR=100*(TP-P1)/P1                   :REM growth rate in percent
300 REM ----------------------- plot results -----------------------------------
320 MX=0                                :REM keep-graph-on-scale loop
322 FOR I=0 TO 80:Q=SC*P(I)             :REM get scaled population
324 IF MX<Q THEN MX=Q                   :REM found larger population?
326 NEXT I
327 IF MX>22 THEN SC=SC/2               :REM too small? then magnify
328 IF MX<11 THEN SC=SC*2               :REM too big  ? then reduce
331 LOCATE 2,60:PRINT USING "year   ##########"; Y;
332 LOCATE 3,60:PRINT USING "POP.   ##########";TP;
333 LOCATE 4,60:PRINT USING "births ##########"; B;
334 LOCATE 5,60:PRINT USING "deaths ##########";TD;
335 LOCATE 6,60:PRINT USING "rate   #######.#%";GR;
336 LOCATE 7,60:PRINT       "scale            ";
337 LOCATE 7,65:PRINT                   1/SC;
340 FOR I=1 TO 79                       :REM plot population
342 Q=24-INT(P(I-1)*SC+.5)              :REM invert y axis, round off pop.
343 IF I=79 THEN FOR J=80 TO 100:Q=Q-P(J-1)*SC:NEXT J:Q=INT(Q+.5)
344 R=PP(I-1):IF R<24           THEN LOCATE R,I:PRINT " ";:REM erase old
346 :           IF Q<24 AND Q>0 THEN LOCATE Q,I:PRINT "o";:REM plot new
348 PP(I-1)=Q:NEXT I:Y=Y+1:GOTO 100     :REM save old point for erasing
1000 REM ======================== DESCRIPTION ==================================
1010 REM
1020 DATA -                             ISLAND                                 -
1025 DATA -
1030 DATA Eleven couples (all persons age 20) land on a desert island and set
1032 DATA up housekeeping.  This program graphs the population vs. age in the
1034 DATA society.  You can change assumptions about birth rates and death
1036 DATA rates in lines 2115 through 2124.  The graph shows ages 0 through
1038 DATA 78.  The last point (age 79) is the total population above age 78.
1040 DATA The vertical scale changes automatically to follow population sizes.
1042 DATA Also printed are the total population; deaths; births; and growth
1044 DATA rates in percent.
1099 REM
1100 REM ---------------------- global variables -------------------------------
1110 REM P(A)    population of age A (population in cohort age A)
1112 REM TP      total population
1114 REM P1      total population a year ago
1116 REM PA      population over age 45
1118 REM TD      total deaths this year
1120 REM B       total births this year
1122 REM B1      total births last year
1123 REM D       deaths in this age cohort
1124 REM GR      population growth rate in per cent
1200 REM ---------------------- local  variables -------------------------------
1210 REM I,J,A   loop variables
1212 REM A       age variable
1214 REM SC      scale factor for height in the plot
1216 REM MX      temporary maximum pooulation (scaled), for finding largest
1218 REM Q,R     temporary values to plot or erase from screen
1220 REM PP()    array of points to erase next plotting time
1222 REM A$      temporary storage of description to be printed
1224 REM S$      scale to be printed at top and bottom of graph
1226 REM Y       current year date
2000 REM ======================== INITIALIZATION ===============================
2010 GOSUB 2100                         :REM declare variables
2040 GOSUB 2700                         :REM print explanation
2050 GOSUB 2500                         :REM draw initial screen
2099 GOTO   300                         :REM plot starting population
2100 REM -------------------- variables and arrays -----------------------------
2110 DIM P(100),S$(100),PP(100)              :REM array dimensions
2115 DEF FND(A)=.001+.11/(A*A)+.1*(A/70)^5   :REM death rate by year function
2120 REM DEF FNB(A)=.35                      :REM birth rate by year function
2121 REM DEF FNB(A)=.08-.15(TP<200)          :REM island limit about 200
2122 :    DEF FNB(A)=.22*(40-A)/20           :REM older mothers have low rate
```

```
2123 REM DEF FNB(A)=.21*(TP-PA*3)/TP        :REM aged pop decreases births
2124 REM DEF FNB(A)=.3*(TP-B1*3)/TP         :REM year olds decrease rate
2125 :   TP=22   :P(20)=TP                  :REM initial population spike
2126 REM TP=5E+09:P(20)=TP                  :REM initial population spike
2130 Y=1985                                 :REM starting year
2135 FOR I=0 TO 80         :S$(I)="-":NEXT I:REM scale
2136 FOR I=0 TO 80 STEP 10 :S$(I)="+":NEXT I:REM ticks every 10 years
2137 FOR I=0 TO 80         :PP(I)= 24:NEXT I:REM set erase array
2199 SC=22/TP:RETURN                        :REM beginning scale for plotting
2500 REM ----------------------- initial screen ------------------------------
2505 CLS:WIDTH 80                      :REM clear screen, set to 80 col.s
2550 FOR I=1 TO 79                     :REM print top and bottom scales
2553 LOCATE   1,I:PRINT S$(I-1);
2554 LOCATE  24,I:PRINT S$(I-1);
2599 NEXT I:RETURN
2700 REM ------------------------ explanation --------------------------------
2710 CLS:PRINT:PRINT:PRINT             :REM clear screen
2715 FOR I=1 TO 10:READ A$:PRINT "       ";A$:NEXT I
2750 LOCATE 22,23:PRINT "PRESS 'SPACE BAR' TO CONTINUE"
2752 IF INKEY$<>" " THEN 2752
2799 RETURN
8000 REM Written in BASICA on an IBM PC with an 80 col. green screen monitor.
8002 REM For some other computers, use GET for INKEY$; and HTAB, VTAB for
8004 REM LOCATE.  These are not exact replacements, see your manuals.
```

Listing 2. Population Explosion program.

```
1 REM ======================= POPULATION EXPLOSION ===========================
2 REM file name:POP EXP            disk name:C3                  E. H. Carlson
200 REM ========================== INTEGRATE =================================
202 REM
204 CLS:PRINT"     All populations in billions":PRINT
205 PRINT "  year    popul.  increase   total":PRINT
208 READ Y1,P1,C$:Y2=Y1:P2=P1          :REM get start year and its pop.
210 GOSUB 250                          :REM print start values
215 READ Y2,P2,C$                      :REM get next year and its pop.
220 DY=Y2-Y1                           :REM length of interval
225 P=(P1+P2)/2                        :REM trapezoidal rule for integration
230 DN=P*DY/30:DN=DN/1000              :REM assume average life of 30 years
235 N=N+DN                             :REM sum for total population
240 Y1=Y2:P1=P2                        :REM ready for next interval
244 GOSUB 250                          :REM print results for the period
245 IF Y2=1985 THEN END                :REM end of program
249 GOTO 215
250 REM ------------------------- PRINT RESULTS ------------------------------
252 PRINT USING "####.##";   Y2;
253 PRINT USING "#####.###"; P2/1000;
254 PRINT USING "#####.###"; DN;
256 PRINT USING "######.###"; N;
257 PRINT         "   ";     C$
260 FOR T=1 TO 2000:NEXT T              :REM pause to read
299 RETURN
800 REM ------------------------ POPULATION DATA -----------------------------
808 DATA -50000,     1.7, Neanderthal man disappears
809 DATA -10000,     4  , Glaciers retreat; herding and agriculture
810 DATA - 5000,     5  , Villages cluster in Fertile Crescent
811 DATA - 4000,     7  , Horses domesticated
812 DATA - 3000,    14  , Writing; pyramid of Zoser in Egypt
813 DATA - 2000,    27  , Square-sailed ships with 2 or 3 masts
814 DATA - 1000,    50  , David king in Jerusalem
815 DATA -  500,   100  , Battle of Marathon in 490
816 DATA -  200,   150  , Carthage surrenders to Rome
817 DATA      1,   170  , There is no 'year zero'
818 DATA    200,   190  , Rome establishes medical licenses
819 DATA    400,   190  , Colosseum closed in Rome to save money
820 DATA    600,   200  , Plow with coulter opens up Europe
821 DATA    800,   220  , Charlemagne crowned in Rome
822 DATA   1000,   265  , Lief Ericsson discovers Vinland
823 DATA   1100,   320  , Jerusalem falls to Crusaders
824 DATA   1200,   360  , First paper mill in Europe
825 DATA   1300,   360  , Londoner executed for burning coal
826 DATA   1400,   350  , Playing cards invented in 1392
827 DATA   1500,   425  , Hieronymus Bosch paints SHIP OF FOOLS
828 DATA   1600,   545  , Shakespeare AS YOU LIKE IT
829 DATA   1650,   545  , Minuet newest dance in France
830 DATA   1700,   610  , Captain Kidd the pirate
831 DATA   1750,   720  , FANNY HILL written by John Cleland
832 DATA   1800,   900  , First suspension bridge with iron chains
833 DATA   1850,  1200  , Singer sewing machine invented
834 DATA   1875,  1325  , Bell invents telephone
835 DATA   1900,  1625  , Reed discovers cause of Yellow Fever
840 DATA   1925,  2000  , MEIN KAMPF published
841 DATA   1950,  2500  , YOUR SHOW OF SHOWS on NBC TV
842 DATA   1975,  3900  , Personal computing
843 DATA   1985,  5000  , THE THINKING TREE published
900 REM Population figures from ATLAS OF WORLD POPULATION,
901 REM McEvedy and Jones, Penquin Books Ltd., London, 1978
910 REM Events from THE PEOPLE'S CHRONOLOGY, Trager, Holt
911 REM Reinhart & Winston, New York, 1979.
```

of square yards of earth surface (including the oceans). It is hard to keep a smile on your face when your personal space consists of one square yard!

One sign of our times is the oft repeated statement that "90% of all scientists who have every lived are alive today." I believe this quote goes back to Haldane in the 1920's, and that the correct percentage for the 1980's would be somewhat lower. Even so, why so many scientists? The answer is not so much that nowadays we need or can support many scientists, but that a substantial fraction of all people who have ever lived are still alive today.

Population Explosion

Run the Population Explosion program (Listing 2). It computes the total number of people who have ever lived by summing over populations starting 50,000 years ago and dividing by an average life span of 30 years. The answer is near 40 billion, or only 8 times the present population.

The population estimates in the DATA statements of this program come from McEvedy and Jones, *Atlas of World Population History* [2]. I chose the starting date of 50,000 BP (years before the present) because the Neanderthals disappeared about that time, leaving modern man to explode into civilization. The world population was then about 1.7 million compared to 5 billion now, so even extending the time back to 100,000 years (when Homo sapiens first appeared) would add only about 10 billion to the total of "the number of people who ever lived."

The other number I grabbed out of the air for this calculation was an average life span of 30 years. I would appreciate any clues you may offer for making a better estimate to replace this wild guess.

The programs in this article model interesting human population issues. In a later column I will return to a less important but still fascinating population conundrum: How do the individual 17-year locusts know which year to emerge as adults in order to be in the crowd? ■

References

[1] G.M. Weinberg and D. Weinberg, *The Design of Stable Systems*, John Wiley & Sons, New York, 1979.

[2] C. McEvedy and R. Jones, *Atlas of World Population History*, Penguin Books, 1978.

Why Every Serious User of an Apple IIe is Buying RAMWORKS™

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EXPANDABILITY Ramworks was designed with the future in mind. As your needs increase, so can Ramworks. Clear instructions show you how to plug in more memory.

CO-PROCESSOR POWER A memory expansion connector on Ramworks will allow future co-processor cards to access the Ramworks memory, so you'll be able to take advantage of the new 16 and 32 bit microprocessors. This connector will also allow Ramworks to be expanded another 2 megabytes, so as memory technology improves, so will Ramworks.

SPEED Today, as programs become more and more sophisticated, they inevitably become larger. And many of today's best selling programs (like Appleworks) won't fit in a 128K Apple, so many of these new larger programs continually go back to disk in search of more data. With Ramworks, you can have enough memory so that the entire program will be loaded into Ramworks' memory. This greatly increases the speed of software because your disk runs at 300 RPM, but Ramworks operates at the speed of light!

COLOR The same slot that's used for memory expansion is also the slot that's used for RGB color display, so all those lesser memory cards of yesterday make you decide in advance if you want RGB color. Ramworks lets you decide later to add RGB color. For only $129, an RGB option can be added to Ramworks to give you double high resolution color graphics and 80 column text. All with a razor sharp, vivid brilliance that's unsurpassed in the industry. The RGB option does not waste another valuable slot, but rather plugs into the back of Ramworks and attaches to any Apple compatible monitor. Remember, you can order the RGB option with your Ramworks or add it on at a later date.

COMPATIBILITY, OF THE SOFTWARE KIND Programs like Appleworks, Magic Office System, Flashcalc, The Spread Sheet, Diverse-A-Dos, Supercalc, Magicalc and many others automatically recognize all or most of Ramworks' memory (512K is average). The simple fact is that Ramworks is compatible with more off-the-shelf software than any other RAM card. Ramworks is 100% compatible with ALL software written for the Apple 80 column and extended 80 column card. Additionally, Ramworks can emulate other RAM cards so software written for other cards will run without modification. Software written for Ramworks will not work on other cards. We can emulate others, but others can't emulate us.

COMPATIBILITY, OF THE HARDWARE KIND Unlike others, Ramworks is fully compatible with hardware add on's from other companies, like the Sider and Profile hard disks. And Ramworks was designed in accordance with the official expansion rules defined by Apple so you don't have to worry about compatibility problems. As you continue to expand and make your Apple more powerful with other expansion products from Applied Engineering, you'll appreciate how each product has extra features designed to work with Ramworks and other products to give you a total performance package that is more powerful than the sum of its parts.

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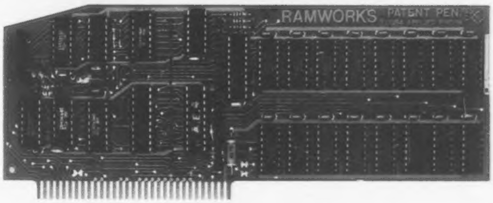

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TELETALK

Have you heard the one about the traveling salesman?/**Corey Sandler**

Breaker, breaker. This is Big Daddy comin' at ya from northbound I-95. Would y'all please be ready to download today's fiscal report and accept my edit of the production spreadsheet?"

Or, how about: "You say you want a 16-bedroom Greek Revival mansion with a heated swimming pool in the shape of a guitar? No problem. Let me pull over and query the Multiple Listing Service."

Or, "Something's odd about the reading on this gauge. Let me punch it into my briefcase computer here and let the mainframe run a quick 24-hour simulation before we lock up the rig for the night."

Or, have you heard the one about the traveling salesman who filed his orders from his car in the parking lot outside his best customer's factory?

What's wrong with these pictures? Well, we have had the possibility of telecommuting from offices, hotel rooms, and factory floors using transportable and then laptop computers for some time now. But the difference here is the severance of the tie that binds computers to the telephone system. Think of the wireless computer as the ultimate cordless telephone.

In my own case, this past winter I suffered through a soul-testing trial in my business as a writer the day my commuter train took a powder just north of nowhere and sat stranded in a swamp for two hours. I was on deadline, with the final draft of a column sitting in the memory of a portable computer on my lap, and there was no way for me to do anything but grit my teeth and listen to the batteries drain. Oh what I would have done for a jungle drummer, a smoke signaler, or a kid with two tin cans and a very long piece of string.

Well, beam me up, Scotty. The next time I travel I just might be able to modulate and demodulate my deathless prose from the middle of the Meadowlands, the top of the chairlift, or an air mattress in the middle of a swimming pool.

We are on the threshold of the widespread use of the wireless modem, the next logical step in the progression from the 12-ton mainframe to the wristwatch sub-microcomputer.

You have already seen private two-way radio modem systems in use if you have had dealings with two of the more ubiquitous business entities in our society: Federal Express and IBM. Federal Express links video terminals in many of its delivery trucks to a dispatching computer. Many IBM repair people in major cities carry small portable computers with radio links for communication and diagnostic assistance.

A Marriage Made in Silicon

A company called Electronic Systems Technology has married an FM transceiver to a modem and a battery pack. You can plug it into any computer, including a laptop portable, or you can buy their model which comes with everything the wireless worker could ever ask for. All you need is another transceiver and a 6" whip antenna, and you're in business.

The next time I travel I just might be able to modulate and demodulate my deathless prose from the middle of the Meadowlands, the top of the chairlift, or an air mattress in the middle of a swimming pool.

The EST cordless computer can transmit within a one-mile radius inside a factory or office, or as far as 30 miles across fields and valleys (or streets and alleys) if larger, roof-mounted antennas are used.

AT&T and Bell Atlantic have begun an experiment in the Baltimore and Washington metropolitan area in which they equipped some of their customers with modems that tied portable computers into the cellular telephone system for on-the-go worldwide telecomputing.

The EST Quest Portable Computer combines a 16K computer, a wireless modem, and a heavy-duty battery pack.

Recently, a number of U.S. airlines began flying with the ultimate in cordless telephones: a model that can link the passenger in the air to any telephone on the ground. And, yes, it is possible to strap on an acoustic coupler to make Flight 753 into your own personal flying radio modem. (The handpiece is a bit on the boxy side, so you had best travel with some masking tape and rubber bands.)

The AT&T device under test is a black box, blessed with the clever name of CTS 1620. Operating at a zippy 2400 baud, the device works much like any other modem, modulating the digital 0's and 1's of a computer signal into an analog warble for radio transmission.

The technical tricks that had to be solved were related to the nature of the cellular radio system and the transmission and reception problems engendered by the concrete canyons of major cities.

The early radio telephone systems relied on a single large antenna and transceiver for a metropolitan area. The system could accommodate only a limited number of users, and most cities had vast dead spots into which the signal would not travel. The replacement system, in widespread use now for about two years, is called the *cellular* telephone network. This system has a number of low-powered base stations spread through a metropolitan area. Each station has its own transmission and reception frequencies.

Assuming that the mobile phone user is in a car, as the vehicle moves from one cell and into another a computer-controlled system hands over the call to the next cell and switches the fre-

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Charles Hostetler,
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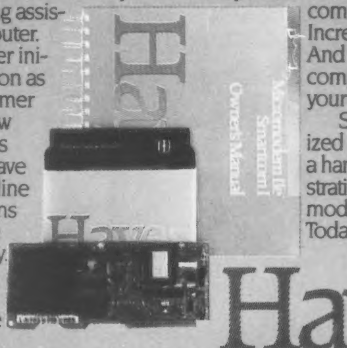

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CIRCLE 143 ON READER SERVICE CARD

quencies. The computer takes about 100 milliseconds to make the switch, which is faster than even your Aunt Millie talks. In theory, then, human users will never know the difference. However, your computer or an ordinary modem just might realize that there has been a break in the line or a shift in receiving frequency. You could lose the link, or if the changeover occurred in the middle of transmission of data, the computer could miss a few characters, or drop a few digits from a financial statement.

Other problems include "ghosting" of signals in and among the skyscrapers and general distortion caused by environmental factors.

A lot of effort—and a significant amount of cost and transmission overhead—is often devoted to error detection and correction hardware and software. (Consider the fact that simple parity-checking, the lowest level error correction system, adds a 14% load to data with the addition of its eighth bit parity indicator.) Other types of error correction can add as much as 50% overhead to a data signal—another way of stating that is to say that error correction can cut by half the amount of information transmitted in a particular time period.

It is important at some point to consider distinctions among types of data for telecommunication. If the computer is being asked to monitor the heartbeats of a critically ill patient, or to send telemetry to control the blastoff of the Space Shuttle or convey multimillion dollar buy and sell instructions for an investment banking house, there can be no allowance for error. Better to have slow, totally accurate information than fast and wrong data.

On the other hand, if the data is a word processing file or an interoffice electronic mail memo, the 1-in-100,000 character garble that changes "soup" to "soap" won't make all that much difference, and in any case the real meaning should be evident in the context in which it is presented.

AT&T claims it has perfected a proprietary means of modulation of the signal between the cellular phone and the base station that will help eliminate problems brought about by ghosting and distorton. In the area of error fixes, the system uses an "automatic request for repeat" protocol that has the modem ask for retransmission if a block of data doesn't come through properly. The method is similar in concept to the XModem system used in some microcomputer telecommunications systems. XModem breaks data into blocks that can be checked back to the transmitting modem by the receiver.

According to AT&T, the system will work just about anywhere a cellular telephone will operate, although throughput (the net number of corrected characters) will drop in troublesome areas.

AT&T is also making a big point of the encryption capabilities of its test modem. Many government agencies and major corporations worry about sending their secret information over public radio networks. If you have ever picked up an older cordless phone and listened in to your neighbor's kids engaged in the commerce of teendom, you'll understand the innocent half of their concern. The darker side involves industrial and governmental electronic espionage.

ESteem wireless modem

ESTeem Model 84 Wireless Modem allows computers and peripherals to be networked together without cables.

The AT&T system under test includes an encryption/decryption device in the cellular telephone and a similar device at the central office of the phone company, with the signal proceeding from there in unscrambled form over ordinary telephone company lines. An alternative under study would have the signal remain encrypted all through the phone system, with the customer having a decryptor at each end. This latter option should allow the user to include full DES or similar encryption with secret keys.

The companies and agencies testing the AT&T/Bell Atlantic system include the federal government, insurance and banking representatives, and real estate agents. In one instance, a real estate company is using the system to link an agent in an automobile to the Multiple Listing Service database in a central mainframe. Laptop computers in use in the test include models from Hewlett-Packard, Data General, Radio Shack, and other manufacturers.

The CTS-1620, part of AT&T Technologies' Cellular Telecommunications System, is not yet available in a retail version. Its price is expected to be in the range of $1500 to $2500. The user will also have to have a cellular telephone and transmitter—at an additional $2000 or so.

Do-it-yourself Network

The EST wireless modem is designed for private networks that do not necessarily tie into common carriers such as the phone company. The ESTeem wireless modem, priced at $995 in its simplest model or $1195 in a CMOS battery-powered version, can link as many as 255 computers or peripherals. The model that includes its own laptop is based on the NEC 8021A portable, and sells for $2295. One interesting application of this package calls for direct warehouse inventorying using a bar code reader.

While the AT&T cellular modem might be used by a traveling salesman on the road, the EST system is more likely to be used within the confines of a large factory, warehouse, or office. Or, it might be installed at a wellhead to transmit data back to a central monitoring site, or carried by forest rangers or security personnel on patrol. In certain circumstances, the company claims, an office might choose to connect computers to each other or to printers and other peripherals using a wireless link instead of going to the trouble and expense of installing wiring.

The wireless modem will accept data at any standard speed from the RS-232C communications port of any computer and store it in a buffer where it is formed into "packets" and then transmitted in bursts of information at 2400 baud. A built-in Z80 microprocessor controls the one-watt transceiver and error correction activities. The transceiver uses VHF FM radio at frequencies between 72.040 and 72.960 MHz. The user can select one of 24 available channels and a unique address for each node on the network.

No special software is required—I tried the device with *PC-Talk* and *Crosstalk XVI* at a demonstration linking an Apple IIc to an IBM PC.

EST is located at 1031 N. Kellogg St., Kennewick, WA, 99336. The phone number is (509) 735-9092. With luck, I'm located on the beach right now, miles away from the nearest power line and telephone. ■

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AMIGA
The Message is the Medium

> *"In the future, everyone's house will be a total entertainment center. . . In the future, TV will be so good that the printed word will function as an art form only . . . In the future, there will be machines which produce a religious experience in the user."*
>
> —David Byrne, *Kneeplays*

While the pro forma prophecies of the nerd wave poet and resident genius of the group Talking Heads are undoubtedly a tad overstated, there is at least one real point within them to be considered. That concerns the future of the computer not as mere number cruncher or problem solver, but as a medium of communication. I will not belabor an argument for the validity of the concept—because you are reading a copy of *Creative Computing*, I will assume you may be spared. You already know why a computer should feature great graphics and sound. You already know that no matter what machine you use, the promise of windows and menus is a worthy one. You already know that micros with output in the same range of sophistication and real-time involvement as television are where the future of creative computing will come to rest, and you can hardly wait.

Evolutionary War

A little over two years ago, two gentlemen from a small joystick company called Amiga paid us a call at the lab. David Morse and David Reisinger had no more than a pitch and a slideshow to show us, but we were impressed by their savvy and their sincerity. They spoke of a custom chipset from Jay Miner, the man who designed the Atari 400/800 chipset. They spoke of graphics and sound of a quality yet unimagined in a personal computer. They spoke of a commitment to an MPU that allowed true multitasking and RAM in excess of 5Mb. I broke the story of the Amiga computer, then code-named Lorraine, to the world back in early 1983.

Time passed, and at successive Consumer Electronics Shows, I viewed the progress of the Amiga. It was a room full of breadboards, then a table full. It was driven by a mini-computer development system, then by a PC. ROM dates slipped and slipped and slipped, but finally the Amiga existed in a single breadboard unit with three custom VLSI ROMs socketed upon it. Now, after one of the most excruciating waits in the industry, not to mention acquisition (for $25 million) by Commodore, the Amiga computer is ready.

Hardware Specs

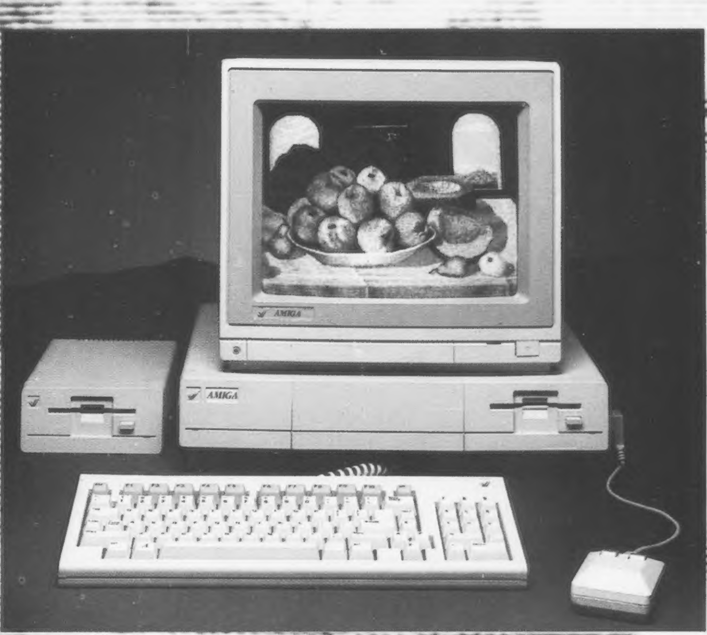
The Amiga is based on the Motorola MC 68000, which is a 16-bit processor with many attributes of a 32-bit MPU, capable of a cycle rate of 7.8MHz. It ships with 256K of RAM expandable to 512K onboard and up to a whopping 8Mb externally. It also holds 192K of ROM and real-time multitasking operating system with a bevy of sound, graphics, animation, and housekeeping support routines.

In addition, as standard equipment the Amiga sports an internal 3.5" dual-sided microfloppy disk drive capable of storing 880K per disk. The drives format disks into 80 tracks of 11 sectors per track, 512 bytes per sector. Reads and writes are DMA (direct memory access) controlled on a full-track basis. Drives are rated at up to a 5.6K read or write on a single revolution. Expansion is possible to three additional daisychained drives, including 5.25" drives.

The Amiga also ships with a fully programmable serial port, allowing speeds up to 31,250 baud, and a fully programmable parallel port, normally configured for the Centronics standard. There are ports for RGB, NTSC, and RF modulated video, as well as two controller ports and an expansion bus for RAM, additional floppies or hard disks, and other peripherals. Audio outputs are discussed ahead.

The keyboard is an 89-key full-stroke detached console with ten function keys, directional cursor keys, and a numeric keypad. Key layout is modified Selectric-style, with a decent, if slightly mushy, feel. One of the nice design features of the machine is the fact that the system unit is raised, allowing the keyboard to slide beneath it for storage.

The system unit is Apple biege, low-



Photograph by Jeff MacWright

Commodore Amiga

CPU: Motorola 68000, 7.8MHz

RAM: 256K, Expandable to 512K inboard, 8Mb externally

Ports: Parallel, serial, controllers (2), video in/out, stereo audio, expansion bus

Keyboard: 89-key, full-stroke, detached, 10 function keys

Display: RGB, NTSC, RF modulator, up to 80 columns x 25 lines

Operating System: Intuition (proprietary)

Disk Drives: One built-in, maximum of four, 3.5", 880K

Summary: If the price drops, could be the next-generation standard in graphics and sound machines

Price: Quoted at press time as $1295

Manufacturer: Commodore Business Machines, Inc.
1200 Wilson Dr.
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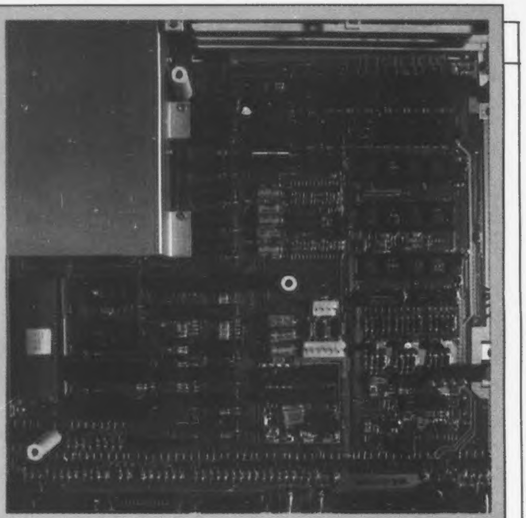
True Selectric-style keyboard is a first for Commodore. Dual-button mouse allows for reviewing options on the fly.



Under the hood: a motherboard designed to maximize circuit efficiency and minimize interference.

slung, with a footprint slightly smaller than that of the IBM PC. A cartridge slot in the front of the unit fits the internal RAM upgrade. On the righthand side of the box is the expansion bus, covered by a door when not in use, along with dual controller ports. All other connectors go into the rear of the system unit.

The Amiga comes with a two-button mechanical mouse, which feels good in the hand and moves the screen pointer crisply with a good feel. It plugs into controller port 1.

Three custom chips handle graphics, animation, sound, and I/O tasks that would otherwise tax the MPU greatly, achieving exceptional results. They work in concert with the 68000, "stealing" time on an interleaved basis. (For a technical overview of the custom chips and some of their potentials, see the sidebar.) Both the 68000 and the custom hardware can read and write to the lowest 500K of RAM. Processor speed is enhanced by the system design, which gives the MPU every alternate bus cycle, allowing it to run at full-rated speed most of the time.

The audio channels consist of four low-noise digital voices split into dual RCA phono plug outputs for use in generating stereophonic effects. Each voice can handle a range of nine octaves, with independent and fully programmable waveforms. The audio channels retrieve their control and data via DMA (direct memory access). Once set, each channel can automatically play a specified waveform without further interaction with the processor. Audio digitization is also possible. The digital sampling rate is fully programmable.

The Amiga can dynamically control which part of memory is used for background display, audio, and sprites,

A technical overview/**Sheldon Leemon**

What Makes It So Great?

The Amiga is a creature of many parts, operating on many different levels. At the lowest level sits the hardware, the physical "body" of the computer. The microprocessor, a 16/32-bit 68000 running at 7.8MHz, is the same one used in Apple's Macintosh. But it is Amiga's set of three custom VLSI chips that sets the machine apart from the competition. Code-named Agnes, Daphne, and Portia, these chips act as powerful coprocessors that relieve the 68000 of many burdensome tasks, including maintenance of screen display, graphics animation, polling the keyboard and mouse ports, disk I/O and peripheral control, and sound generation.

Using up to 25 DMA channels (direct memory access that allows them to bypass the processor and address RAM directly), these chips can actually perform their tasks autonomously, leaving the processor free to crunch numbers (which is what it does best). The distribution of system DMA allows four-channel sound, a screen display of 16 colors in the lo-res mode or four colors in the hi-res mode, and disk I/O all to operate simultaneously while maintaining a 7.1 MHz rate in the operation of the 68000.

Let's be a little more specific as to the types of tasks that the custom chips perform. First we'll consider the graphics subsystems. In all modes, the screen is bit mapped. This means that there is no special text-only mode like the one available on the IBM PC, and consequently no restrictions on mixing text and graphics on the same screen in any mode. The two basic display modes are a low-resolution mode in which there are 200 rows of 320 dots each, and a high-resolution mode which displays 640x200 dots. In lo-res mode, text characters can be mapped on the screen so that 25 lines of 40-column text are displayed, and in hi-res mode 80-column text can be displayed on a hi-res monochrome or RGB monitor, while 64-column text can be used with an ordinary television set. Both hi- and lo-res screens can be operated in "interlace mode," which effectively doubles the vertical resolution to 400 dots (while adding a bit of flicker).

The normal bit-map screen is referred to as a "playfield." The Amiga supports the display of two separate

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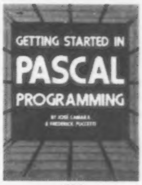
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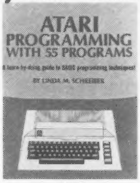
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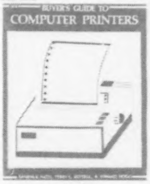
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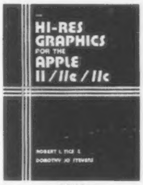
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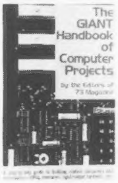
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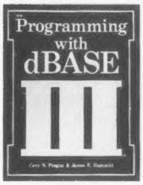
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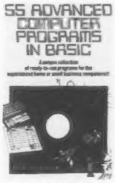
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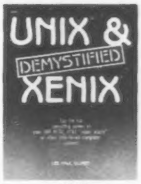
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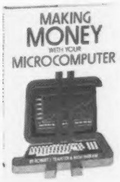
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If card is missing use this address to join: Computer Book Club, P.O. Box 80, Dept CC-985, Blue Ridge Summit, PA 17214 and is not limited to a small, specific area of RAM for screen memory. This allows display bitplanes (of which there are five), sprite-processor control lists, coprocessor instruction lists, or audio channel control lists to be located anywhere within the lowest 512K of the memory map. That same low portion of memory is also accessible to a mechanism called the "bit-blitter" (see sidebar), which can store partial images in scattered areas of memory. These images can then be used for animation effects by means of bit-mapped movement, while saving and restoring background images.

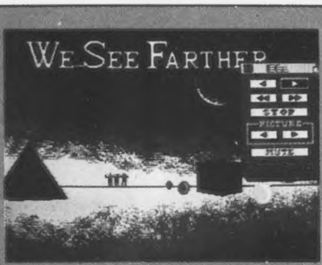
On the back panel of the Amiga is a video input along with multiple outputs. The machine is capable of synchronizing via an optional genlock interface with an external video source. The background color can then be replaced with the input still-frame image. This allows for the development of fully integrated video images with computer generated graphics.

Software Specs

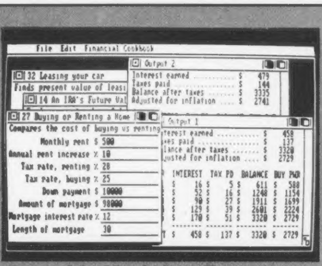
Foremost on the software list of the machine is Intuition, the Amiga user interface. This is a group of system routines that manages a fully-featured windowing system of I/O, allowing flexible use of the true multitasking capability of the 68000 MPU across all graphics modes. Not only can multiple programs reside simultaneously in memory, but they can share system resources with one another. Intuition provides the user with a constant, convenient interface with the operating system and the programs that run within it. At the same time, Intuition provides the programmer with system resources that can run simultaneously with any other program, with no danger of one programming bombing the other or even stepping on its feet. The operant concept is that of a "virtual terminal," wherein each program runs on the equivalent of its own dedicated machine.

On a machine like the Apple Macintosh, there is a single bit-mapped graphics mode, and any type of window can be overlaid on any other. However, in a machine like the Amiga, where graphics modes may depend on complex interrupt-driven color scan techniques, problems are created where one graphics mode of window would be overlaid on another mode of window. The only windows that can cleanly overlay each other are those that share graphics specifications.

Intuition gets around these prob-



Video Construction Set from Electronic Arts.



```
Output 2
Interest earned ............ $    479
Taxes paid ................. $    144
Balance after taxes ........ $   3335
Adjusted for inflation ..... $   2741

32 Leasing your car
Finds present value of leasi
14 An IRA's Future Val

27 Buying or Renting a Home
Compares the cost of buying vs renting
         Monthly rent $ 500
 Annual rent increase % 10
    Tax rate, renting % 28
     Tax rate, buying % 25
         Down payment $ 10000
   Amount of mortgage $ 98000
Mortgage interest rate % 12
   Length of mortgage   30

Output 1
terest earned ............ $    458
es paid .................. $    137
lance after taxes ........ $   3320
justed for inflation ..... $   2729

  INTEREST   TAX PD   BALANCE  BUY PWR
  $    16 $     5 $    611 $    588
  $    52 $    16 $   1248 $   1154
  $    90 $    27 $   1911 $   1699
  $   129 $    39 $   2601 $   2224
  $   170 $    51 $   3320 $   2729
  ------- ------- -------- -------
T $   458 $   137 $   3320 $   2729
```

Financial Cookbook from Electronic Arts.

Early Software Releases

Several software houses have been developing for the Amiga since early this year, using "black box" units. Here is a list of the titles we had uncovered at press time:

- Electronic Arts: Translations of its popular titles *One on One, Archon, Seven Cities of Gold, Sky Fox, Financial Cookbook, Adept, Pinball Construction Set,* and *Adventure Construction Set.* An upgrade translation of *Music Construction Set* will take advantage of the advanced musical capabilities of the Amiga. EA has also announced a spate of brand new titles: *Arctic Fox,* a first-person tank

---

playfields on screen at the same time, with a selectable priority system which determines which will be superimposed on the other. These playfields can be individually fine-scrolled in any direction.

The color selection mechanism is extremely flexible. Since each bit of color resolution requires a fair amount of display memory (8000 bytes in non-interlaced lo-res mode and 16,000 for hi-res), the system allows the user to choose how many bits of color resolution he wants, and to store each bit of resolution in its own "bit plane." The graphics chip has individual address registers for each bitplane, so screen memory does not have to be located in one fixed spot as on the IBM PC, or even to be contiguous for matter.

Screen display information can be located anywhere in the bottom 512K of memory. In lo-res mode, the machine will support 2, 4, 8, 16, or 32 colors onscreen simultaneously. In hi-res mode, there can be 2, 4, 8, or 16 colors. There is even a special Hold and Modify mode in which all 4096 colors can be displayed simultaneously.

Colors are selected through an indirect register mechanism. Each screen dot points to one of 32 12-bit hardware color registers and is "painted" with the color found in that register. By mixing combinations of four bits each of red, green, and blue, the user selects the color for each register out of a palette of 4096 possible colors.

Spritely Animation

In addition to the playfield graphics system, the Amiga supports sprite graphics. Readers familiar with the Commodore 64, Atari, and TI 99/4 computers know that sprites are a separate graphics system of user-defined screen objects that are superimposed on the normal graphics display. The Amiga graphics chip supports up to eight sprites per horizontal scan line. Each sprite can be up to 16 dots wide and from 1 to 200 dots tall, and use up to four colors (the sprites share some of the 32 playfield color registers). Pairs of sprites can be combined to allow up to 16 colors per sprite. As in most such systems, the hardware supports selectable priorities and collision detection that reports when two or more sprites overlap.

Sprites are one hardware solution to the problem of animation. On most micros, bit-map animation requires a lot of programming. To draw a bit-map object on the screen, the programmer must first save the background image, then superimpose the image of the object bit by bit. To move the object, he must restore the old background image, calculate the memory address for new screen position, save the background image at the new position, and then redraw the object.

The Amiga has another solution, a hardware device known as a "blitter." The blitter moves blocks of data bits around at a very high rate of speed. Though it is used primarily to move screen data, it also comes in handy for other types of high-speed memory moves (like filling memory with zeros). To animate a bit-map image, the programmer first defines a blitter object (I like to call it a "blob") by specifying the location of its outline on the screen. From then on, all he has to do is say "move it," and the blitter does so, immediately. Unlike sprites, there is no limit on the number of blobs that can ap-

Screen created with ProPaint from Island Graphics.

simulator game; *Return to Atlantis*, an animated adventure; *Deluxe Video Construction Set*, a video toolkit to bring the animation potential of the Amiga to the nonprogrammer; *Marble Madness*, an Amiga version of the popular new Atari arcade game; and three "creativity products" to be announced soon.

- Island Graphics: Four graphics programs for current release: *Graphicraft*, a low-end paint program; *Graphicraft Pro*, an advanced paint program; *BPGS*, a business presentation graphics system; and *Moviecraft*, a shape-based animation system.
- Microsoft: Microsoft Basic.
- Arktronics: *Textcraft*, a window-based word processor.
- Lattice: Lattice C, the powerful C language for the Amiga.
- Enable: *Enable/Write*, which was to be available at roll-out, and *Enable/Calc* and *Enable/File*, which will be available in the fall.
- Chang Labs: *General Ledger, Accounts Receivable, Accounts Payable*, and *Sales*.
- MetacompCo: Amiga Lisp and Amiga Pascal.
- Borland: Turbo Pascal.
- Lisp Co: Amiga TLC Logo.
- Everyware: *Musicraft*.
- Cherry Lane: *Harmony*, a professional music composer. *—JJA*

lems with a mechanism called "screens." These are distinct from windows in that they can be sized only vertically and can consist of one or more overlapping windows of a single specification. Horizontally, they are full-screen in size. Vertically they scroll just as do windows.

The default screen of Intuition is called Workbench, which is to the Amiga as Finder is to the Macintosh. It allows the user to interface with the operating system within a desktop metaphor, using the mouse to point and click between operations. Intuition provides system exec routines to handle the operation of the entire desktop with the following mechanisms:

- Menus: A complete menu manager.
- Gadgets: Control of windows and input types.
- Requesters: Information input pop-up box.
- Alerts: Information output pop-up box.
- Clipboard: A RAM-based byte stream for data transfer.

If you are not a believer in the desktop metaphor, you can toggle to CLI (command line interface) mode and control the operating system from a command prompt format extremely similar to that of MS-DOS. Amiga DOS is a multitasking program execution environment that is designed to create virtual terminals for all active programs. It supports synchronous and asynchronous I/O, a hierarchical filing system of directories and subdirectories, multiple volume support, device independent I/O, and a RAM disk. Its only limitations are available disk and memory space. It also supports a programmer's toolkit, designed to ease program development by providing access to the huge collection of service routines available in ROM.

Toward a New Medium of Expression

There is not much use in trying to describe the Amiga much more than we already have, although we shall attempt to do so. The fact is that until you see and hear it in operation, you cannot know what it really is. Here, in as vivid a form as I can describe them, are some of the things I have seen and heard the Amiga do:

- A soccer ball bounces from left to right on the screen. It spins slowly on a tilted axis as it moves, showing the facets

pear on the screen at once, and a blob can be any size and use as many colors as the screen display will support.

The only drawback to using blobs is that there is a little more overhead involved in setting one up than in creating a sprite, and if you try to animate too many blobs at once, it can slow down the system. To keep "garbage" off the screen while such complex animation is going on, the Amiga supports double buffering, so that a static copy of the screen is displayed while changes are made to a duplicate copy "off-screen." The graphics hardware contains, in addition to blobs, support for high-speed line drawing and area filling.

The Amiga video hardware supports output to a television set, a composite monitor, a digital RGB monitor, or an analog RGB monitor—virtually every type of display screen available (though the analog RGB monitor that Commodore will be selling is the only kind that can take advantage of both the 640x400 resolution and the 4096 colors). Besides having a multitude of video outputs, the computer also has a video input jack. This unique feature, known as the Gen-lock interface, allows the user to send an ordinary television signal (from a VCR, a video camera, or even another computer) into the Amiga, and to display that picture on the screen with Amiga graphics superimposed.

Sound Ideas

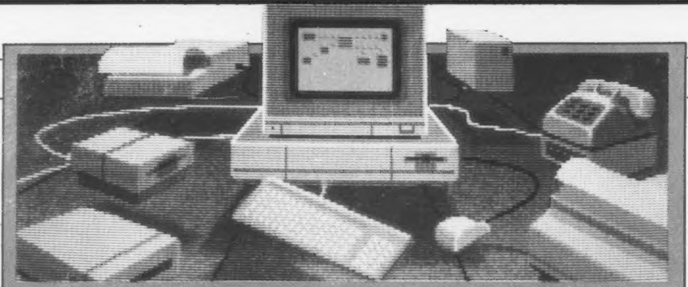
The Amiga custom chip set supports great sound as well as great graphics. The sound synthesizer supports four voices, which are routed to stereo output jacks—two voices on the left channel and two on the right. Each channel has its own 8-bit digital-to-analog converter driven by a DMA channel. Each can produce sounds in a range of about 0-7500 KHz, and has its own 6-bit volume control for 64 volume levels. The programmer controls the tone quality of the sound produced by creating a data model of the sound in memory. The hardware uses this data to generate the waveform shaping and envelope control of the sound.

In addition to synthesized sound, the system supports the reproduction of recorded sounds using a digital sampling technique. For this purpose, stereo audio input jacks are included on the machine. While digital sampling reproduces sounds very accurately, it has been of limited application because it requires thousands of bytes of data for a few seconds of sound. With memory and mass storage getting cheaper all of the time, however, this feature becomes increasingly interesting.

Finally, it should be pointed out that the Amiga is a completely open-architecture machine. The expansion port on the computer gives third-party designers total access to the system hardware and will make the addition of a variety of external devices relatively simple. This will insure that Amiga owners will be able to take advantage of all current technological enhancements, as well as benefiting from future developments.

From the above description it should be clear that the Amiga hardware is exceptional. Even the most impressive hardware, however, requires software to make it do anything. The Amiga ROM Kernel was designed to support fully the hardware, and, wherever possible, to enhance its operation. At the heart of the system is the multitasking system exec-of its surface, changing the direction of spin when it hits a wall. It sounds just the way it should, unmistakably like a ball, rather than a computer imitating a ball. The ball and background are detailed, yet movement is swift and perfectly smooth.

- A detailed humorous, colorful street scene is populated by five blittered characters (not sprites). Each walks, glides, hops, or minces quickly in the correct priority (foreground character in front of background character). The characters are colorful and highly detailed, and even contain "transparent" parts you can see through. Obviously designed by a talented animation artist, the effect is uproarious.
- Multiple multicolored balls animate a collision pattern. Each makes use of sophisticated shading techniques for a shiny, metallic look. Rules governing the effects of collision create a kaleidoscopic, colorful effect—again moving fast but without flicker or jar.
- The keyboard of the Amiga is transformed into a professional synthesizer. Sound is on a par with a Yamaha DX-9. Waveforms run the gamut from banjo to electric guitar to instruments you have never heard before. Tunes can be played in real time or from data files.
- Highly intelligible synthesized speech can output in male or female voices. They pronounce unaltered English spellings with very few errors. Unlike synthesizers for other machines, this one does not require concentration to understand. And it can be called up as an exec from



Peripheral Vision

Because the Amiga design is open, with a powerful expansion bus, we are bound to see a third-party hardware industry grow up around it. At press time, the following hardware peripherals had been announced or slated for Amiga compatibility:

- Printers: Epson FX-80, RX-80, and dot matrix compatibles; Diablo, Brother, and Qume daisywheels; Okimate 20 color, Diablo C-150 ink jet color printers.
- Memory expansion: A 256K add-on cartridge from Amiga. Tecmar is also planning a 1Mb add-on module that attaches to the expansion bus.
- Hard disk: Tecmar is planning a 20Mb hard disk with optional tape streaming backup.
- Clock card: Tecmar includes a battery-backed clock on its memory expansion module and plans a standalone version.
- Genlock: A peripheral, announced by Amiga, that time-base corrects an external video source for interlock with computer-generated graphics. A frame grabber, designed to capture an NTSC video source and digitize it into memory, has also been announced.
- 5.25" disk drive: An IBM format floppy disk drive announced by Amiga implies IBM compatibility sometime in the future. —*JJA*

utive (Exec), which controls the execution of numerous small programs (or tasks), communication between tasks, memory allocation, the sharing of hardware resources, and the handling of interrupts and exceptions.

Exec was designed to facilitate the execution of several tasks simultaneously. The tasks themselves do not have to be designed in any special way for multitasking, since Exec provides each with its own operating environment, and each can run as if it had its own private 68000 processor. Programs actually share processor time, each task getting a minimum time-slice of about 1/15 of a second to run before being pre-empted by the next task on the list. A system of selectable priorities allows higher priority tasks to pre-empt lower priority ones and some tasks to "go to sleep" until a certain event happens. The order in which tasks are performed can also be changed by messages which one task passes to another via the message ports through which the various tasks communicate. Exec also provides a device independent I/O interface by which a task can access a hardware device through a central I/O request block.

Extraordinary Software

The rest of the system software consists of several software libraries. These routines include low-level functions for controlling graphics modes, animation, text, and sound generation. The libraries offer much more extensive hardware support than is normally given by built-in system software. For example, although typical video display hardware is limited in the amount of information it can show on the screen at once, programmers commonly use software tricks to change the display in midscreen so as to achieve better performance than the video chip normally offers.

By careful programming, for instance, an eight-sprite limit can be bypassed by "reusing" a sprite, moving it down to another screen position after it has been displayed once. Most machines require the programmer to perform the critical timing involved. On the Amiga, however, the system software allows the programmer to create "virtual sprites." If he creates more than eight of them, the system itself performs the delicate task of juggling hardware sprites to display these virtual sprites at the correct screen positions.

Moreover, virtual sprites are but a small part of the Amiga animation toolkit. An illusion of animation can be created by flipping through various "views" of a graphic object at a designated rate; moving sub-parts can be linked into a larger moving object; and full collision detection allows the programmer to designate how the animation will change if two sprites or playfield objects collide.

This high level of system support for functions normally performed by applications software is consistent throughout the Amiga system ROM. A window, for example, can be turned into a "viewport" on a scrolling virtual screen of up to 1024x1024 dots. The text package supports font styles like underlined, bold, italic, extended, and even has provisions for proportional print. The sound chip support includes not only facilities for making music and sound effects, but complete support for software speech synthesis, including both phonetic input and text-to-speech conversion. Obviously, the list of examples could go on and on.

Like the hardware, the system ROM was designed to be totally expandable. Wherever possible, it uses linked lists of pointers rather than jump tables or vectors that must be installed at a given absolute address. And, wherever possible, it leaves "hooks" where the user (or future system software) can add functions to the existing ones. Such a design suggests the contemplation of an upwardly-compatible family of elite microcomputers. ■

within any program.

- Digital sound of superlative quality recreates the sound of a basketball hitting a backboard, a car crash, squeaky sneakers, or a recognizable human voice. Though memory intensive, these effects can be read from disk very quickly.

The Downside

I have very few complaints about the Commodore Amiga, but that won't stop me from picking a few nits. I am unhappy with the tooling of the production Amigas I have seen. The plastic is a light-gauge polystyrene, and the pieces don't fit together as well as they should. Even the IBM PCjr case was of higher quality. Though the system unit is rated at a 40 lb. top load, it does not bespeak quality, as it should. The criticism also extends to the keyboard, which feels just a tiny bit loose. According to Clive Smith, marketing VP at Commodore, subsequent production runs will feature better tooling and a heavier case. He promises that the keyboard, too, will be improved.

I found the drives to be slow during certain operations. When loading a directory, for instance, they became a little bogged down. They are also a bit noisy. Smith assures me that these are both software problems that will be solved in production units.

The system lacks a clock. You must set the time and date, if you are interested in such things, every session at boot time.

I failed to find an AUTOEXEC command in DOS. This may have been an omission in the documentation. If however it is not, the possibility of autoboot files could be in question. What is more likely is that setting them will be a bit more work.

The RGB monitor connector is nonstandard. Unless you buy the Commodore monitor to be offered alongside the Amiga, you may be hard-pressed to find the DB-23 connector necessary to wire a custom monitor cable. Commodore will, however, market a generic cable for use with third-party monitors.

The version of Basic I saw lacks a screen editor. Two versions of Basic are planned: one from Microsoft and the other from MetacompCo, a British firm. I examined the latter, and among other things was disheartened by the fact that it lacked any sophisticated form of editor. I ran the Ahl benchmark, but the results were so disparate I cannot assign them any validity.

Part of the reason I'm such a curmudgeon is that I have such high hopes for the Amiga. Please rest assured that it is one hell of a magic box, and that the complaints I have made are largely cosmetic or picky or will be solved by upcoming options.

The real message to come away with is that the Commodore Amiga is a new communications medium—a dream machine. Its display is crystal clear—better than any I have ever seen, in any graphics mode. Its sound far surpasses that of any microcomputer that has come before. Its multitasking computing power and open-ended RAM capability make it a Herculean muscle machine. The expansion port with MPU bus leaves the future wide open for peripherals, including hard disks and CD-ROMs. Make no mistake about it: the Amiga may never inspire a religious experience in the user, but it can serve as the delivery vehicle for extremely sophisticated interactive experiences. And with its canned set of tools, it may come close to providing a religious experience for the programmer. ■

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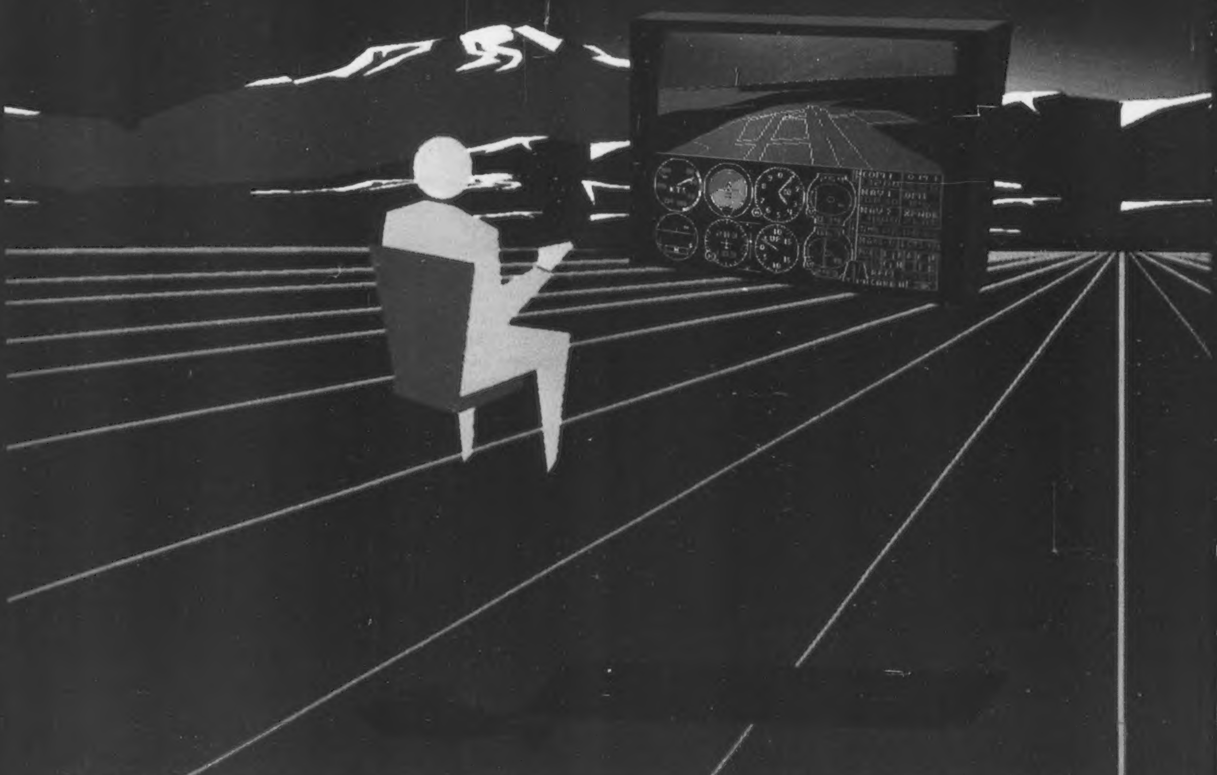

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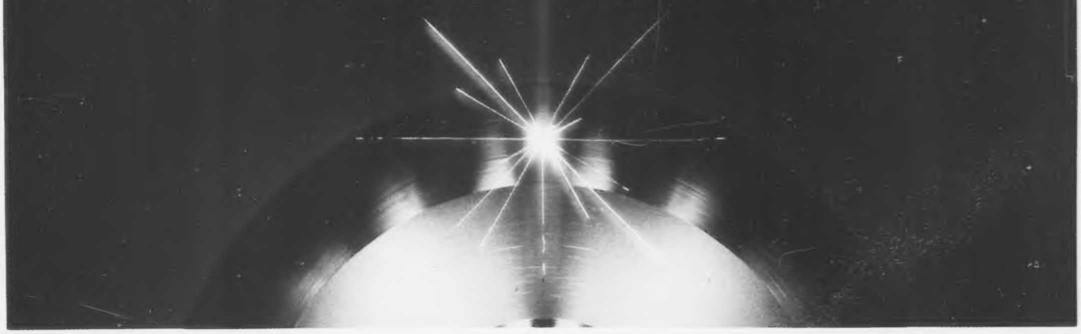
The laser beam, once an esoteric tool in scientific laboratories, has burst forth to become an awe-inspiring symbol of the Eighties. From the Star Wars of George Lucas to the Star Wars of the Pentagon, the power of that concentrated needle of polarized light has emblazoned itself upon popular consciousness.

The first image of laser power that comes to mind is apt to be a weapon cradled in the black glove of Darth Vader. That is an unfortunate association. For we are reaping a technological harvest from the legacy of the laser that is unassailably constructive rather than destructive. Lasers have replaced scalpels in delicate microsurgery. They have made possible the entire field of holography, which holds implications yet to be realized.

Lasers have begun to revolutionize the mass storage of digital information as well, with their ability to transmit huge amounts of information.

That is where this story begins . . .



Photography by Jeff MacWright.

Thomas Edison invented the phonograph in 1877. Using tin foil as a recording medium, it was the first *mechanical* device developed to store sound information. In Germany, during World War II, the Magnetophon company introduced *magnetic* tape recording, a vast improvement over the previous magnetic storage method, wire recording. Also during the 1930s, the first *optical* recording system—soundtracks for motion pictures—appeared.

These recording techniques are still in use today, and each has evolved in its own way. Ironically, the oldest—the mechanical phonograph record—has changed the least. Even though new manufacturing methods and materials have increased frequency response and diminished surface noise, the phonograph record is still limited to storing only audio signals, subject to wear, and easily damaged. Magnetic recording, on the other hand, has flourished and, because it can record and reproduce information other than sound, has become a vital part of most modern technologies, including video recording and computing.

Optical recording, until relatively recently (the late 1970s and early 1980s) has existed as the stepchild of these other storage techniques. Having left behind the limitations of their origin—movie soundtracks—the future of optical media is best represented by two consumer products, laser videodiscs and compact audio discs.

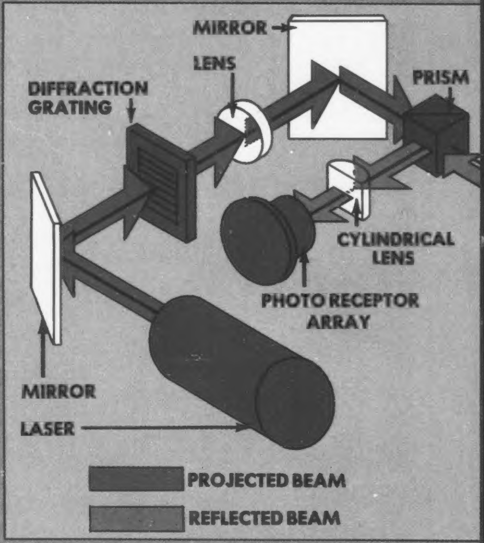
Recording technologies are defined by their ability to store large amounts of information (capacity and density, which is measured as the capacity per square inch or centimeter of the surface of the medium) and to capture and play back information at a high rate of speed (resolution). Video requires greater capacity and resolution than audio, for instance.

In a mechanical device like the phonograph, there are two primary limitations: The width of an individual groove in a spiral track (capacity) and the ability of recording and playback devices to make and detect the variations on the wall of the groove (resolution). With magnetic devices—tape recorders and disk storage machines for computers—the limitations are similar. Each particle of the magnetic material that coats the surface of a tape or disk contributes to the ultimate capacity of the medium. And, record/playback heads must be able to focus magnetic energy on an ever-smaller spot to take advantage of this capacity.

Magnetic techniques continue to improve, however, in terms of both capacity and resolution. One promising development in magnetic storage is the use of new recording media. While tapes and disks have traditionally been coated with a very fine powder of metal oxide or metal particles, new materials have instead a *thin film* surface layer of metal molecules only a few atoms thick. This is accomplished by breaking down metals with a bombardment of high-energy electrons, and then depositing the material on a surface inside a vacuum. These so-called metal evaporation processes (known as "sputtering" and vacuum deposition) have already been demonstrated by Japanese tape companies, and promise to be the basis for new video recorders, digital audio tape recorders, very high density computer floppy disks, and video floppy disk still cameras.

The optical media, however, point the way for the most significant advances in recording for the remainder of this century and beyond. Simply put, optical technologies offer enormous capacities and extremely high resolution, making them ideal for every purpose, from audio recording to information storage on machines not yet invented.

Inside Optical Storage



Optical storage playback makes use of the special qualities of laser light to retrieve the digital data encoded on discs. The light emitted from the laser is of a very narrow band of wavelengths and is strongly polarized so that the phases and orientation of its waves are aligned. This enables various optical devices to manipulate the laser light in ways that ordinary light cannot be handled.

The type of laser and the geometry of the path that the light takes may differ depending on machine and application. However, during typical playback of optical storage, whether audio, video, or computer memory, the following steps generally take place. First the laser emits a beam of coherent light that is broken by a diffraction grating into essentially three parallel beams. Two weaker beams are later used alongside the main reading one to detect tracking errors. The "light bundle" of beams is focused by a lens. The beam then passes through a special Wollaston prism or PBS (Polarizing Beam Splitter) which allows the vertically polarized projection beam to pass directly through but which will ultimately separate the reflected light. The projected beam continues through a quarter wavelength retardation plate. This changes the polarization characteristics of the beam which is then directed by a tracking mirror and finally focused onto the disc by the objective lens.

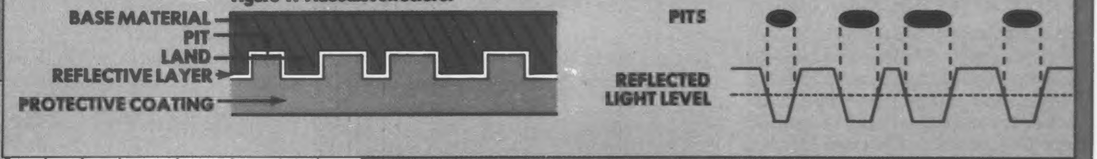
The disc modulates the intensity of the laser light when it falls on either "lands" or "pits" (Figure 1). Raised lands strongly reflect the laser light. The intervening pits have a depth equal to one quarter the wavelength of the laser light. This means that the scattered light they reflect is 1/2 wavelength delayed in relation to the light reflected by the lands (1/4 wavelength each way, in and out of the pit). The scattered light is, therefore, A look at optical recording offers an excellent opportunity to trace the way technologies contribute to one another's development. For optical recording to become practical, other new technologies first had to be invented. The most important of these was the laser. Its ability to generate an extremely fine beam of light makes optical recording possible. Because the physical dimensions involved in optical recording are extremely small (measurements of a micron—a millionth of a meter—and less are common), a means of visually inspecting the recordings was necessary. Without the scanning electron microscope, this would be impossible.

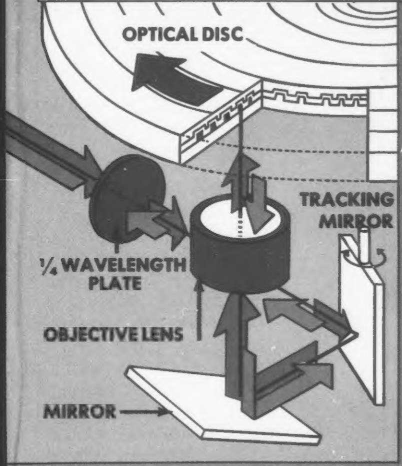
To make copies of optical recordings, the microscopic manufacturing techniques learned from large-scale integrated circuits were required. Finally, to assure that the information coming from an optical recording—particularly digital information—was free of errors, the software technology of error correction was needed. Optical recording relies on all of these, and one exciting new development works partially in conjunction with certain magnetic principles, as well.

Currently, optical recording research centers on three different kinds of media: *Prerecorded* (read-only), *recordable* (write once but read only afterwards) and *erasable* (repeatable full cycles of write, read and erase). The laser videodisc (LV) and audio compact disk (CD) are both examples of read-only discs. They work in almost exactly the same manner, with one major difference. The laser videodisc reproduces an analog signal, and the CD stores and plays back digital information.

The laser videodisc was developed during the early 1970s, at first separately by MCA, the giant entertainment conglomerate, and Philips of the Netherlands, a large electrical and electronics corporation. The two eventually traded patents and jointly finished developmental work on the videodisc. Later, when the manufacturing of prerecorded discs ran into severe technical problems, IBM, which had been conducting its

Figure 1. Videodisc structure.





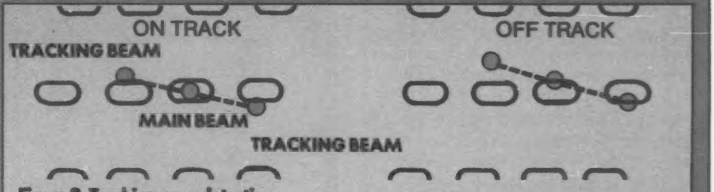


Figure 2. Tracking error detection.

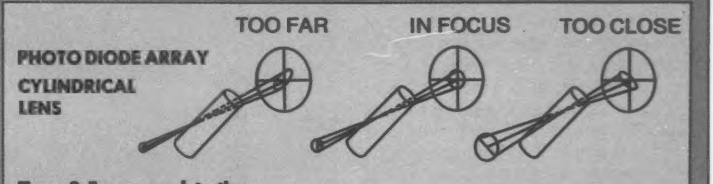


Figure 3. Focus error detection

greatly weakened by interference with the reflected light as wave peaks meet troughs.

On the return trip, the reflected light retraces the path to the retardation plate. This further modifies its polarization, allowing the prism to bend it at right angles to the projected beam and prevent feedback into the laser. The now separate reflected beam is focused by a cylindrical lens and falls on an array of photo diodes.

The first function of the photo receptors is to read directly the variation in beam intensity which encodes the digital information on the disc. This would be impossible, however, without the additional ability of the photo receptors to control the critical jobs of tracking and focus.

The two weaker tracking beams and the primary laser are focused by the objective lens on three different spots on the disc (Figure 2). The intensity of the two reflected tracking beams is compared by separate areas of the receptor array. Differences between them are interpreted as tracking errors, which are corrected by the tracking mirror.

Focus is controlled by detecting changes in the shape of the primary beam. When the disc is in focus, the cylindrical lens will project the reflected beam as a circle on the array of four photo diodes (Figure 3). When the disc moves closer or further from the objective lens, the projection becomes elliptical, with more light falling on one diagonal pair of receptors. This difference is detected as focus error and a servo mechanism adjusts the objective lens.—*Peter Kelley* own optical research, joined the other two companies in a new corporation, known as DiscoVision Associates. In the end, though, all three companies pulled out of the U.S. venture and left the videodisc, all but dead, to Pioneer of Japan, which has since done a remarkable job in correcting many of the technical and manufacturing mistakes of the past.

How the Laser Videodisc Works

Here is how the laser videodisc works. The shiny surface of the 12" (30-centimeter) videodisc is encoded with tiny—a little more than a micron wide—*pits* or surface deformities arranged in a spiral track. The length of each pit and the distance between one pit and another determines the information. In this case, it is a single signal that contains the video, color data and audio. (Color and audio are buried in the signal as *subcarriers.*)

This encoded video signal also includes other information such as frame numbers and running time. The data are part of the *vertical interval,* the unused lines of a video picture you can see when a television set is not adjusted properly and the image "rolls." Some of these lines are used for "closed captioning" (numbers and words that can be superimposed on the screen for the benefit of the hearing impaired) and for VITS, a reference signal used by certain TV receivers to automatically adjust color, hue, and tint.

The surface on which the pits are etched is sealed with a thick coating of optically clear plastic, called a *scuff coat,* which then becomes the first surface of the disc, the only one you can actually touch.

To read the disc, a beam of light originates from a very low-powered laser (typically less than 5 milliwatts and about as bright as a common flashlight) and travels to the inside surface of the disc by a system of lenses, mirrors, and prisms. When the beam is reflected by one of the pits, its polarity changes. It travels back along the original path to a special prism (called a Wollaston prism) that can differentiate between the light going to the disc and the light—now carrying information—reflected by the surface. The laser beam then strikes a photosensitive electronic element that converts it to a video signal.

While this process seems simple, it is actually quite complex and, in practice, demands extreme precision. In a videodisc player, for instance, the beam is actually split into several parts, some of which are used to keep the main reading beam centered on the proper track. It is also necessary to mount the objective, or focusing lens, inside an electrical servo mechanism so that it can precisely follow-focus the inside surface. This lens moves up and down to adjust for errors in flatness and accommodate disc warpage. And, of course, the disc must be *perfectly* centered—the spindle hole placed exactly in the center of the disc—so that the optical system can follow the spiral track while it rotates.

If a mechanical phonograph record is either warped or not properly centered, the sound comes out with an annoying "wowing." (It is distorted by time errors.) Nonetheless, the record does play; it makes sounds. Videodisc players contain mechanical devices (moving mirrors and lenses) and electronic circuitry to correct for such time distortion. Too much warpage or a grossly off-center track, however, will cause an optical record not to play at all.

SONY
CD COMPACT PLAYER
COMPACT disc DIGITAL AUDIO
DIGITAL
OPEN

Sony D-5 revolutionized digital audio with its diminutive size. Selling now for under $200, it is hardly wider than a disk itself and less than two inches deep.

Other common problems in optical records are caused by dust and dirt trapped between the surface and the scuff coat (a piece of common house dust can be several times wider than a track on the disc) and malformed pits. A videodisc player sometimes cannot properly follow the narrow spiral track, leading to visual distortion known as crosstalk, in which the laser beam reads part of the tracks adjacent to the one it is trying to play.

As originally designed, laser videodiscs can be recorded in one of two formats. The first, called *standard play* or *CAV* (for constant angular velocity) can contain up to 30 minutes of NTSC (U.S. standard) video in motion or up to 54,000 still frames per side. The CAV discs rotate at a constant speed of 1800 RPM, which corresponds to 30 times per second, the exact frame rate of NTSC standard television. So, for each rotation of the videodisc, one single TV frame is reproduced.

The second videodisc format is called *extended play* or *CLV* (for constant linear velocity). CLV discs rotate at variable rates of speed, depending on which part of the disc is being read. At the beginning of a disc (the inside tracks, nearest to the center hole), it spins at 1800 RPM and gradually slows until, at the end (the tracks nearest the edge) it is rotating at a third of that rate, or 600 RPM. The reason? Each video frame on a CLV disc occupies the same length of spiral track. The disc begins with approximately one frame per rotation, but as the diameter increases, one rotation equals three frames. This effectively doubles the playing time (60 minutes per side) while sacrificing some of the unique features of the CAV disc, such as still frame, slow motion, and reverse play.

The videodisc is an important model for all present and most future optical technologies. Most current optical methods are improvements on or refinements of this technology.

Compact Discs and CD-ROM

Compact discs, for example, are really miniature videodiscs, 4.7" (120 mm) in diameter, that reproduce digital audio instead of analog video. All CDs are CLV format discs, since there would be no benefit to an audio "still frame" or slow motion playback. They rotate at between 500 RPM (at the inside) and 200 RPM (outside). The maximum playing time is about 70 minutes per side.

The digital information contained

on the discs is read out in serial fashion, one bit after the other, at a rate of about two million bits per second. Inside the CD player, electronic digital-to-analog circuitry turns the data into sound. Because CDs are subject to the same kinds of problems as videodiscs—including warpage, surface defects, and crosstalk—the integrity of the information is protected by redundant recording and a software error correction technique known as the Reed Solomon Cross Interleave Code (CIRC).

Pioneer CLD-9000 is the first dual audio/video disk playback unit. In addition to laserdisk and CD playback, the unit offers video playback with digital audio on laserdisks with dual format audio tracks.

As of this writing, no double-sided compact discs have been pressed for consumer consumption. A common manufacturing practice is press the CD with the same information on both sides. After both sides are checked for errors, the side with the highest rate is chosen for imprinting with the label, rendering it useless.

The advantage of both LV and CD discs is that they are suitable media for storing virtually any kind of information. Laser videodiscs can contain digital audio, and, in fact, a new format devised by Pioneer Laserdisc Corporation puts two digital audio tracks in the unused space *between* video tracks. Likewise, compact disks with full video and computer graphics have been demonstrated by Sony. The design specifications of the compact disc designate several megabytes as *user bits*, currently allocated for text (on-screen video "liner notes," etc.) and video graphics. Forthcoming new CD players will have video outputs for connection to a monitor or TV set, in addition to standard audio outputs.

Since compact discs and laser videodiscs have such enormous capacity and can transfer information at very high speeds, it seemed obvious that someone would suggest their use as a computer medium. In 1984, Sony and Philips proposed the CD-ROM (For Compact Disc—Read Only Memory), and standardized on a format that organizes the 540 million bytes (or characters) contained on the disc into 2000-byte blocks. Not long afterwards, Pioneer suggested the laser videodisc for a similar purpose, naming it the LV-ROM (for LaserVision ROM). The LV-ROM, claims Pioneer, has a capacity of over 1 gigabyte (1 *billion* bytes of information), when played on a specially modified videodisc player.

It is widely believed that the CD-ROM will have enormous impact on all types of computing. Several startup companies, including Cytation, Inc., a San Francisco group with ties to the consumer electronics industry, are involved in developing collections of data appropriate to the gigantic capacity of the CD-ROM. Any large database in existence seems to be a likely candidate for pressing on a CD. Most often mentioned are newspaper and magazine files (an entire year of the *Wall Street Journal* or the New York *Times* on a single side?), government records including patent and copyright files, catalogs (the Library of Congress card catalog), volumes of legal proceedings, and, of course, encyclopedias (the all-time favorite "blue-sky" prediction of optical media proponents).

It is obvious that the ideal information for CD-ROM is already available via online database services. Information services like Nexis and Lexis—the literature and legal search systems of Mead Data—could conceivably be threatened by the CD-ROM publishers. Or, the online services might themselves become suppliers of CD-ROMs. In any case, most online services will retain a slight edge in their ability to update their records instantly.

Still, the vast majority of information sold by these services are old files which require few changes. A CD-ROM issued each month could easily serve the needs of many present users. Compact discs are inexpensive; mastering one costs less than $5000, and each copy costs less than $5. These prices are very low when compared to paper publishing.

Unfortunately, the business of applying compact disc technology to computers is not as simple as plugging a CD player into a PC. One of the greatest hurdles is standardization. Even though the information on CD-ROMs is organized in a standard way, a standard hardware interface between the players and personal computers has yet to emerge. A hardware interface standard is essential, because audio CD players are designed to transfer information serially, while most personal computers use a parallel scheme for communicating with disk drives. Settling on a standard hardware interface will also allow the creation of optical disk operating system software for CD-ROMs.

The SCSI (for Small Computer Systems Interface, pronounced, oddly enough, "scuzzy") is one, though not the only, proposal for such standardization. It is based on the SASI (the first two initials of which stand for Shuggart Associates) interface already in use in PCs for hard disks. Other proposals include the IEEE-488 bus and high speed RS-232 serial transfer.

Manufacturers of CD-ROM players are quoting transfer rates from disk of about 153,000 bytes per second—not quite as fast as an audio CD, but fast enough for even the most demanding information applications. Access between the 2000-byte blocks of information is claimed to be 50 milliseconds, with the longest time required to go between widely spaced blocks being 1.5 seconds.

Most Japanese manufacturers, including Hitachi, have expressed interest in the CD-ROM system. In the United States, 3M Corporation and Digital Equipment Corporation also have plans for the disk, and IBM is rumored to have a similar interest. Sony was the first to demonstrate a CD-ROM system in operation with an IBM PC in fall, 1984. A sample CD-ROM containing several hundred graphic screens and a database of Olympic sports records has been circulating among hardware and software developers throughout 1985.

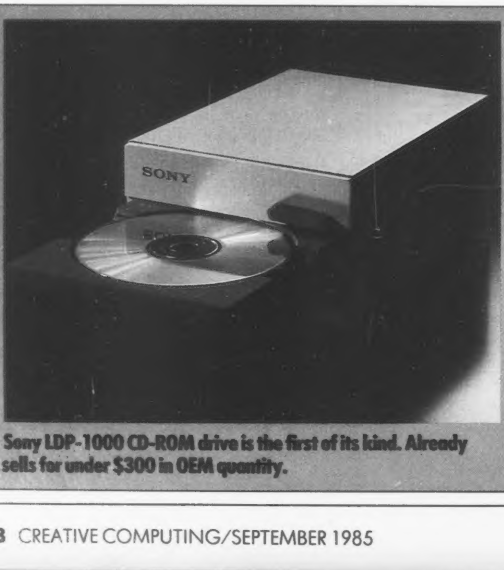
The expected manufacturer's price for a CD-ROM player (minus the interface and software) should eventually be $250 to $300. A complete subsystem for a personal computer should retail for about $1000 to $1500. Considering Sony's recent breakthroughs in price and miniaturization of players (notably its Walkman-style D-5 CD player), this goal seems reasonable. All indications are that CD-ROM players should begin showing up in the United States in the last quarter of 1985 or the beginning of 1986.

DRAW and WORM Research

While compact discs cannot (yet) be recorded on the same machines on which they are played, recordable optical discs have existed for several years either as laboratory projects or in limited commercial production. This type of disc is known as DRAW (For Direct Read After Write) and WORM (Write Once, Read Mainly). Like other optical devices, it can be designed to record audio, video, or data.

These write-once systems are basically adaptations of the original laser videodisc scheme, with an important addition. They use a higher-powered laser to write the information on a material. Pits are formed by either *vaporizing* or *physically deforming* the surface of the disc. Another method involves changing the structure of certain unique chemicals.

Originally, DRAW research centered around the first kind of process, in which the pits were burned into the reflective surface. The videodiscs themselves were constructed from something often referred to as a "tellurium-air sandwich." Tellurium is a metal used as a component of blasting caps, produced mainly by the United States, Canada, Peru, and, not surprisingly, Japan. When hit by laser light, the tellurium destroys a tiny portion of the surface around it, forming a pit. Discs produced in this manner can be played on a standard LV disc player.



Sony LDP-1000 CD-ROM drive is the first of its kind. Already sells for under $300 in OEM quantity.

Phase change DRAW materials work very differently. The disc surface is coated with a compound of rare earth metal materials that can go from a *crystalline* to an *amorphous* chemical state and, in doing so, alter its reflective properties. When the material is crystalline, it is highly reflective. In its amorphous state, it is absorptive, or non-reflective. DRAW discs are written and read with high and low-powered laser beams. High-powered beams cause the phase change, low-powered beams read the information already recorded. Most phase change systems are irreversible, so they cannot be accidentally erased. While manufacturers claim long shelf life, the longevity of a phase change is still questioned by some scientists.

Some erasable optical media also use phase-change principles. Energy Conversion Devices, of Troy, MI, is an innovative company which has devised a reversible (or erasable) phase change material and has licensed its use to Hitachi and Matshushita in Japan. Hitachi has also announced another erasable material which is a chemical compound of tin, tellurium, and selenium.

If there is a bet to be made on the future of optical storage media, though, most industry analysts would place it on an exotic and, until recently, little known process known as *magneto-optical recording*. As its name implies, magneto-optical techniques rely on both magnetic and optical sciences. The major keys to this recording process are two well-known physical phenomena, the Curie effect and the Faraday effect.

The Curie effect involves raising a magnetic material to a specific temperature called the Curie point. At this temperature, and while exposed to a magnetic field, the material becomes magnetized. The area raised to the Curie point can be smaller than the magnetic field, however. In other words, the magnetic field being created by a recording head can be several times larger than the spot on the material being recorded.

The density of magnetic records is determined not only by the size of magnetic particles, but also by the ability of the recording head—essentially a coil—to focus the energy. The Curie effect allows this concentration of energy to be determined by the diameter of a laser beam used to heat the surface, *not the recording head*. In practice, making a magneto-optical recording involves focusing the laser to a spot a micron or so in diameter, then magnetizing the surface with a relatively large magnetic head that does not even need to contact the disc. Because only this small spot is heated to its Curie point, it alone is magnetized. The remainder of the particles on the surface are left unaffected.

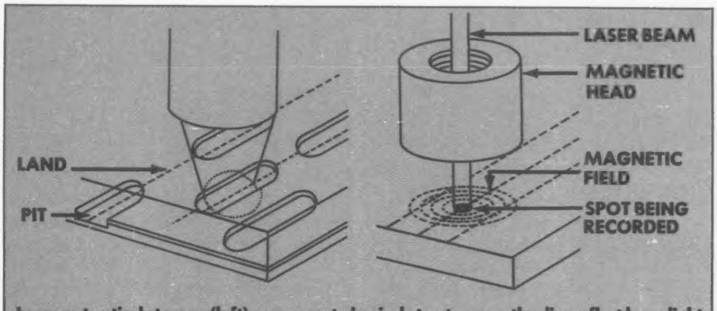
Usually, the same magnetic head is used for both playback and recording. But if the magnetized spot is much smaller than the recording head, how can it be read? This is where the second important phenomenon comes in.

British scientist Sir Michael Faraday found that when light is reflected from a magnetic surface it is changed. Light waves are either random or polarized in a particular direction. To better understand this, experiment by crossing the lenses of a pair of broken Polaroid sunglasses or, better still, an old pair of 3-D movie glasses. (Simple explanations of polarity can also be found in most high school physics textbooks.) When light is reflected back from a magnetized surface, its polarity changes—it is rotated—ever so slightly.

This rotation is nearly undetectable, from about 0.05 (five hundredths) to 0.3 (three tenths) of a single degree. It is enough, however, to be read by an optical and electronic device.

Again a product of continued technological advancement, magneto-optical recording is attractive because capacities meet or exceed those of the LV or CD disc. Magnetic materials are familiar to researchers, and a magneto-optical disc can be recorded, played back, erased, and recorded again without practical limit. This is truly a recording technique for the next century, although it is almost certain to begin its impact before the end of this decade.

In the United States, 3M Corporation and IBM are developing magneto-optical discs, with AT&T believed to be hovering in the wings. In Japan, the research is almost feverish and is centered at KDD, a well-known developer of telecommunications equipment. TDK Corporation, however, with its deep understanding of magnetic materials is actively pursuing inexpensive magneto-



In current optical storage (left) permanent physical structures on the disc reflect laser light in different intensities. Read/write function becomes possible by combining magnetic and optical technology (right). In recording, only a small part of the disc medium within the magnetic field is magnetically altered when its temperature is raised to the Curie point by a focused laser. On playback, the polarity of the laser light is susceptible to rotation due to the Faraday effect of the magnetized area on the beam. Differences in laser polarity (not luminence differences as in strictly optical technology) are detected. Reheating the spot without the magnetic field serves to erase the data when the medium is magnetically realigned to its original orientation.

As we go to press, Verbatim has announced the completion of the first phase of the development of an erasable read/write optical disk and disk drive. The company will now begin product development of the drive and a 3.5" thermo-magneto-optical disk that can store a minimum of 40Mb of formatted information or 20,000 pages of typewritten text.

optical materials and recently showed its first samples of 12" discs to the press. A Sony project, lead by Dr. Senri Miyaoka, the inventor of the Trinitron picture tube, might yield a magneto-optical audio or videodisc player by the end of 1985.

While there is definitely a laser in the future of almost every consumer of electronic and technical goods, one more issue looms.

Where Do We Go Next?

Recording has gone from the mechanical cylinder, to mechanical disc, to magnetic tape, to magnetic disk, to optical disk, and finally, to the magneto-optical disc. Does it stop there? If not, where do we go next?

Drexler Technology of Mountainview, CA, says the next move is a credit card-sized piece of plastic striped with its proprietary optical recording medium called Drexon. This material, which begins as silver-based and photosensitive, is specially processed to take on a shiny appearance. Information can be printed on the card in the form of microscopic spots read with a low-power laser. A slightly higher-powered beam, however, can also write information by burning through the reflective surface to reveal a black, absorptive layer underneath.

The Drexon LaserCard, which costs about $1.50 in production quantities, can currently store up to 2 million bytes of information, the equivalent of about three printed books. Recently, the card made headlines when it was adopted for use by Blue Cross of Maryland, whose members will carry their medical information on "LifeCards" as they have been dubbed. While a Drexon card can't yet compete with the capacities of the laser videodisc or CD, the company says it will increase the capacity to perhaps 20 million bytes by decreasing the size of the spots. (Drexler seems fit to the task. Its products, other than the Drexon card, serve the microelectronics manufacturing industry.)

Already, Drexler has issued 20 technology licenses to companies around the world who are interested in building readers and recorders for the cards and exploiting their potential. Of these, there are four licensees in the United States: Blue Cross of Maryland, Wang Laboratories, NCR Corporation, and Honeywell, most of whom are tight-lipped about their intentions.

Drexler has granted 11 licenses to Japanese companies, almost all of whom make computer, electronic, or consumer products: Toshiba, Matsushita (Panasonic and Technics brands in the U.S.), Canon, Fujitsu, Omron, Computer Services Corporation (Japan's largest vendor of computer software), Gakken (a book, magazine, and educational publisher), Logitec (which has demonstrated a Drexon card-based video game), Nippon Coin Company (vending machines), Olympus, and Sharp. Japan's *Dempa Shimbun*, the electronics industry trade newspaper, says Matsushita plans to introduce a Drexon card reader late in 1985 or early in 1986, priced between $150 and $200.

The optical card may be propelled by Japan's current fascination with credit cards, which have only recently become of interest to the masses. The credit card has given rise to credit card-sized calculators and microprocessor-based "debit cards" (both from Casino). In 1984, green public telephones that accept magnetic cards (sold in various denominations at candy counters and cigarette stands) made their appearance on the streets of Tokyo. The new Washington Shinjuku Hotel uses magnetic-striped cards as room keys. Their size? Credit card, of course.

One of the most potent new industrial alliances with intentions for developing an optical card is TMP, Tokyo Magnetic Printing. It was formed last year as a joint venture of Toppan Printing (Japan's largest) and TDK Corporation. Although its name says *magnetic*, the company's future is probably *optical*. TDK is rapidly becoming more familiar with optical, high-density magnetic and magneto-optical storage techniques, while Toppan is already well-advanced in its own optical research project, mass replication of *holograms*. The potential of holography for mass information storage has barely been explored, but it could eventually lead to recording densities and resolutions far, far beyond those of today's media.

The idea of using a card, instead of a tape or disc isn't just a gimmick. An optical card is a far more elegant device for storing information. It does not move, so it does not need a problematic center hole, like a disc. Instead of spinning, a scanning laser beam illuminates the surface. And, since it is usually pressed against a window when read or played back, warpage is not a problem. Instead of a pile of floppy discs, videocassettes, videodiscs, or compact discs, the entire library, filing cabinet, video, and record collection of a home or office might one day be contained in a small envelope, or—for those with the hording instinct—a shoebox.

In any case, the gods of modern technology have spoken. They have said: "Let there be light . . . " ■

Zenith Z-151

Choice of the U.S. Air Force and Navy/**Russ Lockwood**

When Uncle Sam announced his intention to spend your tax dollars on a microcomputer, the competition among manufacturers must have been fierce. In the end, Zenith came out the winner, with a $99.8 million order for 10,500 Z-151 desktop computers specially modified for use by the U.S. Air Force and Navy in high security "Tempest" applications. While you cannot buy the military model, you can own the consumer version of the Z-151, an excellent IBM PC compatible.

Like other desktop compatibles, the Z-151 consists of three components: a display, detachable keyboard, and system unit housing the cpu, disk drives, and electronic innards of the system. In terms of style, the Z-151 looks like a piece of military hardware—a touch too boxy. It is certainly not as sleek as some other computers that pass through our office. But before you judge this computer by its system unit cover, know that it is as close to an IBM PC as you can get without copyright infringement.

It uses an 8088 microprocessor, supports an 8087 numeric co-processor, runs MS-DOS, and comes with 128K RAM (expandable to 640K), two serial ports and a parallel port, and two 5.25" 360K floppy disk drives. An optional 10.6Mb Winchester hard disk drive can replace one of the floppy drives.

The left half of the Z-151 system unit holds eight expansion slots, of which four contain the CPU board, graphics board with NTSC and RGB ports, floppy disk drive controller board, and RAM board with 128K (expandable to 320K). This leaves four slots open for other expansion boards. If you buy the hard disk version, the drive controller board occupies one of these open slots.

The detachable, slant-adjustable keyboard is a work of art, for Zenith chose to improve the IBM PC keyboard rather than mimic it. The keyboard is completely electronic, and the tactile feedback is rather good. The aural feedback, a subdued electronic click with each keystroke, is acceptable when typing: one key, one click. But if you move the cursor a lot, this can really grate on your nerves.

The ZVM-133 RGB monitor has a dot pitch of 0.41mm, slightly better than the IBM Color Display. The big difference is a button that transforms your color display into an easy-on-the-eyes green screen. (See our February 1985 issue for a full explanation of the intricacies of RGB monitors.) This can be

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F1 - Help
F2 - Balance Sheet Menu
F5/F6 - Prev/Next Chart
F7 - Show Data

Photography by Jeff MacWright.

Hardware Profile

Name: Zenith Z-151 **Type:** Small business computer
CPU: 16-bit 8088, 4.77 MHz **RAM:** 128K (expandable to 640K)
Keyboard: Detachable, 84 keys, slant adjustable
Display: 80 x 25 characters; 320 x 200 pixels (four colors)
Disk Drives: Two 360K 5.25" floppy drives
Ports: Two RS-232C serial and one parallel; NTSC and RGB on graphics board
Dimensions: System unit: 16" x 16.5" x 6.3"; Keyboard: 18.2" x 8" x 1.3"; Display: 16.7" x 13.7" x 15.2"
Operating System: MS-DOS **Documentation:** Looseleaf user's guide
Summary: Quality IBM PC compatible offers excellent compatibility and best keyboard layout we've seen
Price: 320K, graphics board, and two floppy drives $2699; ZVM 122 monochrome monitor adds $139.95; ZVM-133 RGB color monitor adds $309
Manufacturer: Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8949

a boon to those who want monochrome for word processing and color for other applications.

Zenith includes a three-ring, looseleaf owner's manual with information on using MS-DOS and GW-Basic.

Zenith claims that the Z-151 is highly compatible with the IBM PC and runs most off-the-shelf IBM PC software. As evidence, they include a list of 131 packages that were tested and "believed to be generally compatible with today's IBM PC."

Heading the list is *Lotus 1-2-3*, which also happens to be the de facto standard of IBM PC compatibility. The Z-151 ran version 1A with absolutely no problems. Buried in the list is the other paragon of PC compatibility, Microsoft *Flight Simulator*. Again, the program ran perfectly.

In fact, a wide variety of business, education, and entertainment programs ran without error and seem to indicate that the Z-151 runs just about everything except for some Basic programs written for the IBM PC.

Thus, we reiterate our standard line regarding IBM PC compatibles: try the package you want to use before you buy the computer. Based on the *Lotus 1-2-3* and *Flight Simulator* tests, we feel confident that the Z-151 will run most software.

The base model with 128K RAM, one 360K floppy drive, one parallel and two serial ports, and a graphics board costs $2199. The 320K RAM, two floppy drive version sells for $2699. The 320K RAM, one floppy drive, and one 10.6Mb Winchester drive model retails for $3899. All models include MS-DOS and GW-Basic.

The ZVM-122 monochrome monitor sells for $139.95, and the ZVM-133 RGB color monitor sells for $309.

New Offerings

Zenith has recently expanded its line of IBM PC compatible computers. The new offerings are:

Z-138: A 24-pound transportable with built-in 7" amber display, which retails for $2099 for 128K RAM and one floppy drive and $2399 for 256K RAM and two floppy drives.

Z-148: An entry level system for home, office, and school. Costs from $1899 to $2199.

Z-158: An enchanced version of the Z-151, which includes a "turbo" switch to boost operating speed by 60%. The 128K RAM, one drive machine retails for $2499; the 256K dual drive model, for $2899; and with a 10Mb hard disk drive, for $4099.

Z-200: An IBM PC AT compatible with 512K RAM and one 1.2Mb floppy drive. Retails for $3999.

A Final Salute

Give Zenith a medal for manufacturing an excellent IBM PC compatible. The Z-151 combines terrific IBM PC compatibility, competitive price, and an excellent keyboard layout. Zenith Data Systems, a major manufacturer with commitments to the U.S. government, will support and service their computers for a long time to come. Business people and professionals looking to purchase a microcomputer would do well to check on the Zenith Z-151. ■

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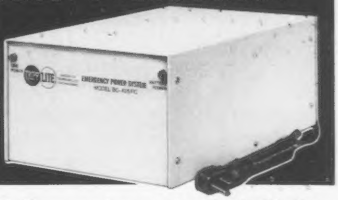

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CIRCLE 157 ON READER SERVICE CARD

PRINT ABOUT PRINTERS

Color printers: Worth the wait?

Owen Linzmayer

Beginning in this issue, our popular Print about Printers column returns to the pages of Creative Computing. *In addition to thorough printer reviews, the scope of Print About Printers has been expanded to include information on the printer industry, related products and accessories, and insightful discussions of new printer technologies.*—OWL

In Print About Printers this month we discuss three technologies used in the current generation of color printers: impact dot matrix, thermal transfer, and ink jet. We also examine two representative printers in the first two categories and one in the third.

Flying Colors

Although color printers have been available for several years, only recently have falling prices brought them within reach of the average computer user (see Figure 1). Increased competition between printer manufacturers coupled with recent advances in technology have resulted in the introduction of a variety of low-cost printers capable of producing a rainbow of colors in addition to that old standby, black.

The demand for color printers has developed as the popularity of computers capable of generating and displaying color graphics has increased. Having grown accustomed to transferring word-processed text from screen to paper, users began to look for ways to capture their dazzling color graphic displays on paper. The new breed of low-cost color printers combined with appropriate software now makes it possible for virtually anyone to join the color revolution.

Not everyone needs a color printer. For the vast majority of users, color printers represent an attractive luxury, hardly a necessity. If, however, you are a heavy user of computer art or business programs that produce charts in color, a color printer will be a welcome addition to your system.

Software is the key to taking advantage of the full spectrum of features offered by color printers. All word processors that allow you to embed control

			Cartridges		CIRCLE ON READER SERVICE CARD
Printer	**Print Method**	**Cost**	**Color**	**Black**	
Epson JX-80	Impact dot matrix	$699	$16.00	$14.00	403
NEC Pinwriter P2C	Impact dot matrix	999	25.00	16.00	404
Apple Scribe	Thermal transfer	299	5.99	4.99	405
Okidata Okimate 20	Thermal transfer	268	6.69	5.95	406
Canon A-1210	Ink-jet	699	17.00	10.00	407

Figure 1.

Control Code: ESC r (n)
Prints in the color
determined by n.
n=0 — black
n=1 — magenta
n=2 — cyan
n=3 — violet
n=4 — yellow
n=5 — orange
n=6 — green
n=7 — brown

Figure 2. To print text in color on the NEC Pinwriter P2C, you must embed the appropriate ESC codes into the body of the document. Above is the color selection chart.

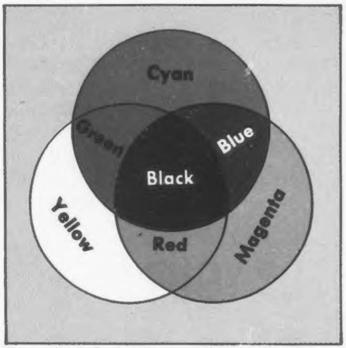
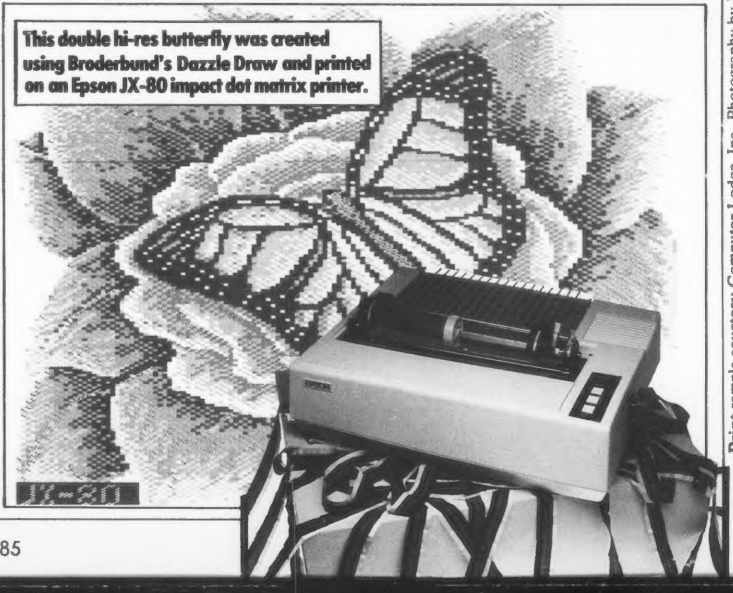


Figure 3. Color printers with tri-color ribbons can create a minimum of seven colors simply by mixing yellow, cyan and magenta in various combinations.


This double hi-res butterfly was created using Broderbund's Dazzle Draw and printed on an Epson JX-80 impact dot matrix printer.

Print sample courtesy Computer Lodge, Inc. Photography by Jeff MacWright.

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- ☐ Electronics Design Technology
- ☐ Industrial Electronics
- ☐ Satellite Communications Electronics
- ☐ Data Communications
- ☐ Telephone Servicing
- ☐ Basic Electronics
- ☐ Small Engine Servicing
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codes can print text in color. For example, "ESC r (1)Warning" is the control sequence that instructs the NEC Pinwriter P2C to print the word "Warning" in magenta (see Figure 2). Even the Macintosh, a monochrome computer, can print in color if it has the correct software driver. Software must recognize the ability of printers to produce colors before you can print in color.

Even though software packages like Broderbund's *Dazzle Draw* are beginning to support color printing, the relative scarcity of color photocopiers has kept color printers from catching on in the business world. A *Lotus 1-2-3* pie chart can easily be reproduced in color using the Canon Ink-Jet printer, but because color printers are slow, it would take days to run off the several hundred copies of a report an executive might need to distribute to his sales force. This problem should diminish in importance as more affordable color photocopies become available.

All color printers, regardless of the printing method used, have several features in common. With the exception of the Canon Ink-Jet printer, which accepts special ink cartridges, all of the printers mentioned here employ multi-color ribbons composed of red, yellow, blue, and in some cases, black strips. If you have ever wielded a crayon, you know that all the colors in the rainbow can be created by mixing the three primary colors (red, yellow, and blue). All of the color printers I evaluate here can create a minimum of seven colors (see Figure 3) by overstriking the primary ribbon colors in multiple passes of the printhead. With the appropriate software they can theoretically produce hundreds of different hues. In addition to the typically more expensive multi-color ribbons, most color printers accept standard black ribbons for those applications in which color is not needed.

Quite an Impression

Impact dot matrix printers are by far the most popular computer printers today. Therefore it should come as no surprise that the first color printers used this technology. Impact dot matrix printers form characters using precisely positioned dots; hence their name. The printhead is essentially a set of vertically arranged print wires (also called pins) that strike the inked ribbon and press against the paper when voltage is applied to them. This impact causes a dot to be printed on the paper. As the printhead moves across the paper, these tiny pins fire rapidly to form characters.

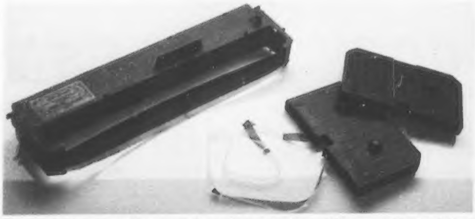


Figure 4. Impact dot matrix color printing utilizes a cloth ribbon (left) which has black, magenta, cyan and yellow ink stripes running its entire length. Thermal color printing uses a wax-based ribbon (middle) with successive bands for each color and a marker between repeating sections. True black printing requires an entirely black ribbon (right).

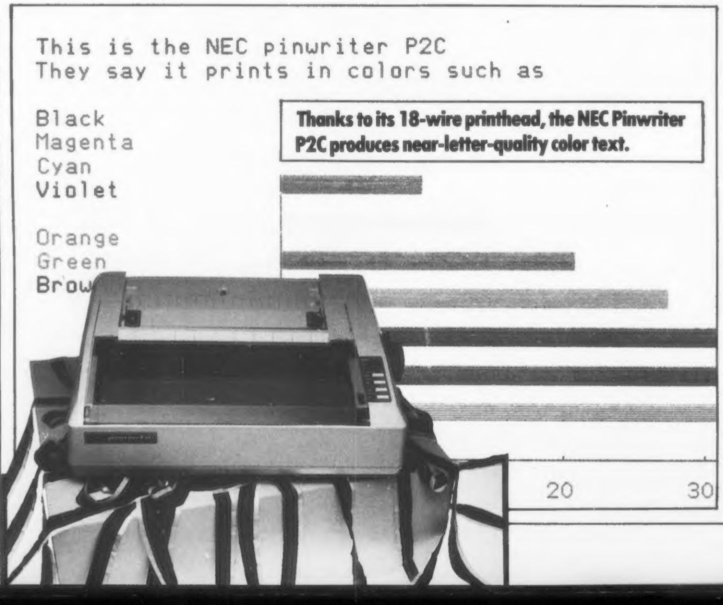
The Epson JX-80 is one of the most widely recognized color printers on the market, which can be attributed partially to Epson's excellent reputation and widespread influence in the printer industry. Listed at $699, the JX-80 offers a print speed of 160 draft characters per second (cps), a bevy of character modes, both tractor and friction feed mechanisms, and seven-color printing.

The JX-80 uses cloth ribbon cartridges (see Figure 4). Like the majority of impact dot matrix printers, the JX-80 produces colors by moving the multicolor ribbon up and down so that the desired color is in front of the printhead when the pins fire. That's all there is to it. When the program instructs the printer to use blue, the blue section of the ribbon moves into position. If a mixed color like green is required, the printer first prints yellow, and then overstrikes with blue. As a general rule, the light colors are printed first.

The major advantage of the Epson JX-80 is that it is one of the best supported color printers as far as commercial software is concerned. The tried and true impact dot matrix technology is well suited to printing on standard paper, which is not the case with thermal transfer printers, as we shall see. The JX-80 is also relatively fast, although it should be pointed out that the speed of all color printers is determined largely by the efficiency of the software driving them.

Drawbacks of the Epson JX-80 include inconsistent impact which results in a washed out quality that is most noticeable on graphic images with large areas of a single color (see sample). Disappointingly, the vibrant colors of a graphics screen lose a lot of their luster when put to paper simply because of the media involved. And finally, the cloth ribbons tend to smear and deteriorate in color quality after extended use.

The NEC Pinwriter P2C is a color version of NEC's immensely popular Pinwriter dot matrix printer. The claim to fame of the Pinwriter P2C is its 18-pin printhead, compared to the 9-wire head of the Epson JX-80. More pins mean superior print resolution and speed (180 draft cps). They also cost you more—the



```
This is the NEC pinwriter P2C
They say it prints in colors such as

Black
Magenta
Cyan
Violet

Orange
Green
Brow
```

Thanks to its 18-wire printhead, the NEC Pinwriter P2C produces near-letter-quality color text.

Photography by Jeff MacWright.

Pinwriter P2C retails for $999.

This NEC printer produces color in much the same was as the JX-80. Additional features include the color brown and a superior near-letter-quality text mode (see sample). The computer of choice for the Pinwriter P2C is the IBM PC, but it can be easily connected to any computer with a parallel interface. The Pinwriter P2C was designed primarily for correspondence, but does a superb job with graphics as well.

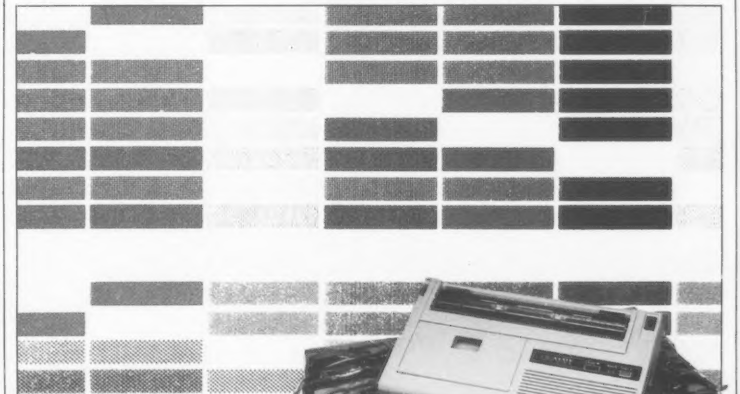
The Heat Is On

Thermal transfer printers arrived on the scene a little over a year ago and have yet to capture a significant market share. One problem is that the major contenders in the printer industry are slugging it out in a price war in which consumers are the real winners. Impact dot matrix printers bursting with features are selling for well under $300, and the inexpensive thermal transfer units with their special paper and ribbon requirements are having a difficult time gaining acceptance.

Thermal transfer printers are dot matrix printers, but differ considerably from *impact* dot matrix printers. Thermal transfer printers like the Apple Scribe and Okimate 20 do not strike the ribbon or paper to form characters. Instead, thermal transfer printheads contain discrete heating elements which gently contact the ribbon and melt its wax-base ink onto the paper. The technology provides extremely quiet operation, but the printers that use it are typically slower than comparably priced impact dot matrix machines. Not to be confused with obsolete, low quality thermal printers, which burn characters onto heat-sensitive paper, thermal transfer printers require special smooth-surface paper for best results.

The Apple Scribe and the Okimate 20 printers use similar,but incompatible, three-color wax-based ribbon cartridges. The ribbon itself is approximately 0.5″ wide and consists of an 8″ band of yellow, followed by an equal length of magenta and then cyan (see Figure 4). To produce the full range of colors, thermal transfer printers must pass through all three color bands for each line of printing. This accounts for reduced printing yield and speed when using color ribbons as compared to standard black. To determine what color is ready for printing, a photosensor on the printhead looks for a small marker located between the cyan and yellow bands on the ribbon.

Seven colors are available on the Scribe and the Okimate 20, yet the latter claims "over 100 sizzling colors." These colors are more accurately described as shades, produced by printing adjacent dots in different combinations of the standard colors (see below). The $299 Scribe is designed primarily for use with Apple IIc and IIe computers and employs a 24-element printhead to produce acceptable near-letter-quality text and double hi-res graphics. The Okimate 20 also uses a 24-element printhead and costs $268, but you must buy a separate Plug 'N Print interface (serial or parallel) for the IBM PC. Okidata also of-


By carefully mixing the seven basic colors available from its wax-based ribbon, the Okimate 20 can create a variety of hues.

Photography by Jeff MacWright.

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CIRCLE 102 ON READER SERVICE CARD

A Matter of Timing

For some time now we have wanted to bring you a review of the Okimate line of color printers, but our effort seemed jinxed from the start—we just couldn't seem to get our hands on a model that worked. We could get the thing to print, but we could rarely get it to print well, and we never got it to print as well as it seemed at CES or other shows.

The problem intrigued us, and we sought far and wide for an acceptable explanation. We have subsequently reasoned from discussions with one of the contract programmers who worked on a software interface for the Okimate that the problem, at least for the Commodore computer, is largely a matter of timing.

The complex ribbon feed for the Okimate depends on exact timing signals from the host computer. Commodore machines are peculiarly inconsistent on this score, and every revision of that machine notoriously displays its own unique benchmarks. The same goes for the 1541 drive, which dynamically reads picture data during an Okimate printout.

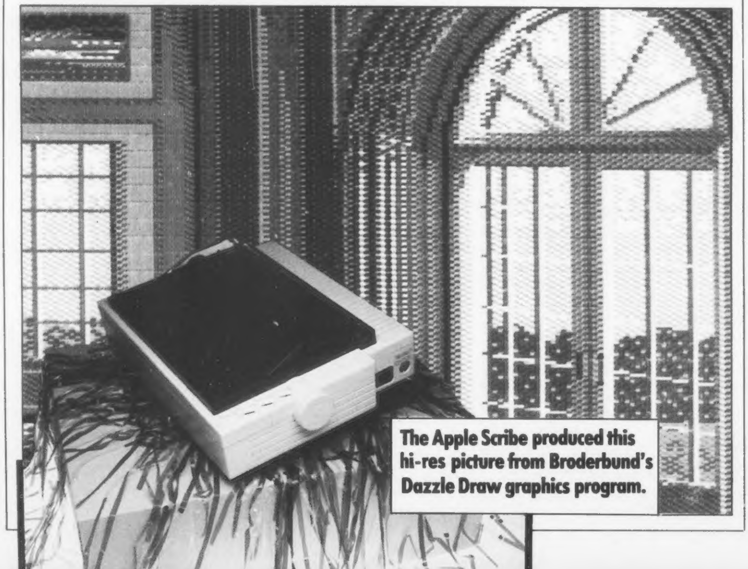
This means that the Okimate may work perfectly with one set of Commodore 64 and 1541 drive, but not another, even though all computers and drives are in perfect working order. According to our very informed source, no sooner would his group spec the software to the latest revision of the hardware, than a new revision would appear with incompatible benchmarks. Oki has gallantly sought to find a real solution to the problem, but if you are a Commodore owner, you should probably remain wary when considering the Okimate.

We had originally chosen the Commodore 64 for our evaluation because we reckoned it to represent the largest potential market for the Okimate series. The evaluation in this article was based on an IBM system. After three tries, we have yet to see the Okimate work reliably with our Commodore.—*JJA*

fers the $239 Okimate 10 for Atari and Commodore 64 owners (see sidebar).

While I am not very fond of the text quality of thermal transfer printers, they outperform everything in their price range when it comes to color graphics. Thanks to the wax-based ribbon, colors are consistent, and brilliant, and actually shine on the printed page. Screen dumps created with impact dot matrix printers can't hold a candle to the beautiful output of thermal transfer printers (see below).

Thermal transfer printers are not without their faults, however. First and foremost is the high cost of the special smooth stock paper and color ribbons which are exhausted after printing only 8-10 pages. Of equal importance is the fact that few software packages take



The Apple Scribe produced this hi-res picture from Broderbund's Dazzle Draw graphics program.

Photography by Jeff MacWright.

XEROX

Three more firsts from the people who invented the wheel.

From day one, Xerox and Diablo have been known as the two best names in daisywheel printers. And now there are three more in the Xerox line to choose from.

The Xerox Advantage D-25 Diablo printer turns out letter quality documents quickly and quietly. And it does all that for the price of a dot matrix printer.

At 80 c.p.s., the D-80IF is the fastest daisywheel printer ever made by Xerox. It has a built-in double bin sheet feeder. As well as the capacity to handle up to 16 computers at once.

Then there's the D-36. It's so reliable, it averages 4,000 hours of printing between maintenance calls.

And each of these new printers is compatible with most computers on the market, including the IBM-PC.

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FOR MORE INFORMATION FROM XEROX CIRCLE #170 ON THE READER SERVICE CARD advantage of the color capability of these printers. With its strong software developer ties, Apple is trying to encourage authors to write color-capable software for the Scribe. Okidata includes with each Plug 'N Print module a helpful utilities disk that allows you to do straight screen dumps and modify the picture by rotating it or by changing parameters such as background color and print size.

Jet Propelled Printer

Ink-jet printers are dot matrix printers of sorts, but instead of striking a ribbon against paper to produce characters, ink-jet printers spray fine droplets of ink. As shown in Figure 8, the printhead of the Canon Ink-Jet printer consists of four ink-jet nozzles (for yellow, magenta, cyan, and black). Each nozzle consists of a small glass tube with a transducer wrapped around the tip. When voltage is applied to the transducer, it squeezes the nozzle and an ink droplet is ejected from the orifice by the resulting pressure. Ink-jet printers that use this method are referred to as "drop-on-demand printers."

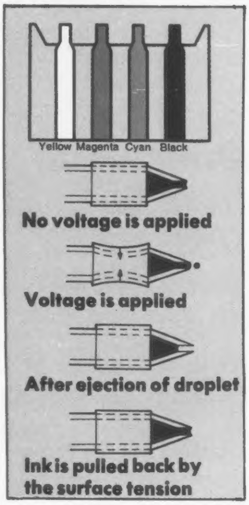
Instead of using cloth or wax-based ribbons, the Canon Ink-Jet printer accepts two ink cartridges, one tri-color and one black, which plug into the front of the unit. A complex series of pumps, filters, and reservoirs is used to draw the ink out of the sacks in these cartridges and prepare it for delivery to the ink nozzles (see Figure 6).

Both impact dot matrix and thermal transfer printers form text characters in one pass of their printheads. However, instead of having 9 or 24 print wires arranged vertically, the Canon Ink-Jet printer has four nozzles arranged horizontally, which means it must make seven passes of the printhead to form a 5x7 dot matrix character (see Figure 7). While this printhead arrangement is less than ideal for printing straight black text, it is well-suited to rapid printing of colors mixed on one line. The Canon Ink-Jet printer doesn't have to fuss with positioning the appropriate ribbon when it wants to print color, it simply applies voltage to the transducer around the nozzle of the desired color. This is the beauty of drop-on-demand printing.

If your primary use of a color printer is to produce lots of color charts and drawings, then the Canon Ink-Jet printer coupled with the appropriate software is a good bet. However, I was disappointed to find that the model I evaluated offers only draft quality text, and its character set does not have true descenders (see below). Obviously this printer will not do double duty for word processing.

I want to stress that there are other color printers available, and that the information in this column is not intended to cover all color printers on the market. Rather, I have discussed those printers which are most representative of the printing methods they employ. Other manufacturers that offer color printers include IDS, Axiom, Hermes, Dataproducts, Atari, Juki, and Facit. ■

Figure 5. The Canon PJ-1080A printhead is composed of four ink-jet nozzles arranged horizontally. When voltage is applied to the transducer that is wrapped around the nozzle, an ink droplet is forced out of the nozzle and onto the paper.


Yellow
Magenta
Cyan
Black
No voltage is applied
Voltage is applied
After ejection of droplet
Ink is pulled back by the surface tension

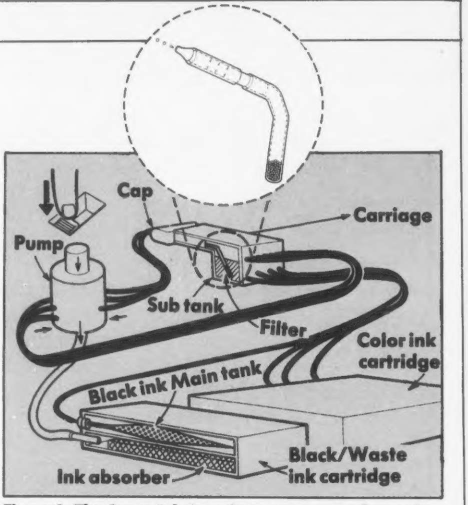


Figure 6. The Canon Ink Jet printer uses a complex series of pumps, filters and reservoirs to draw the ink out of the color sacks and prepare it for the ink nozzles.

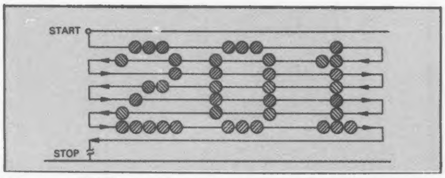
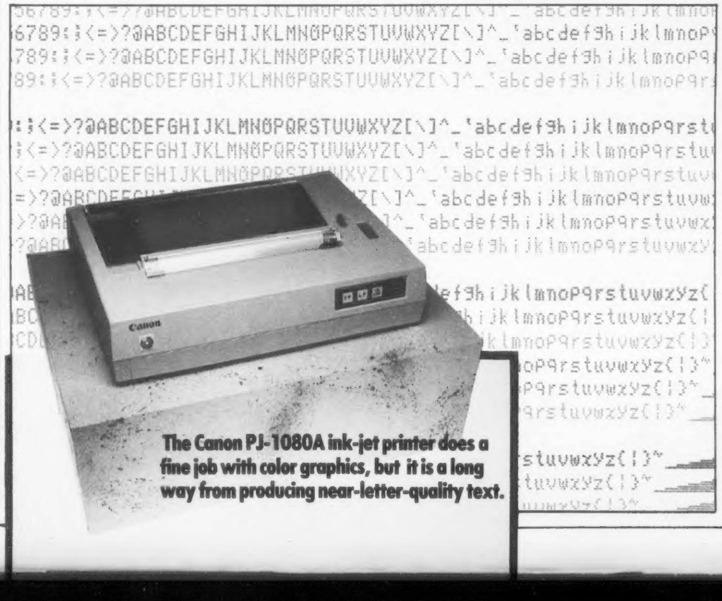


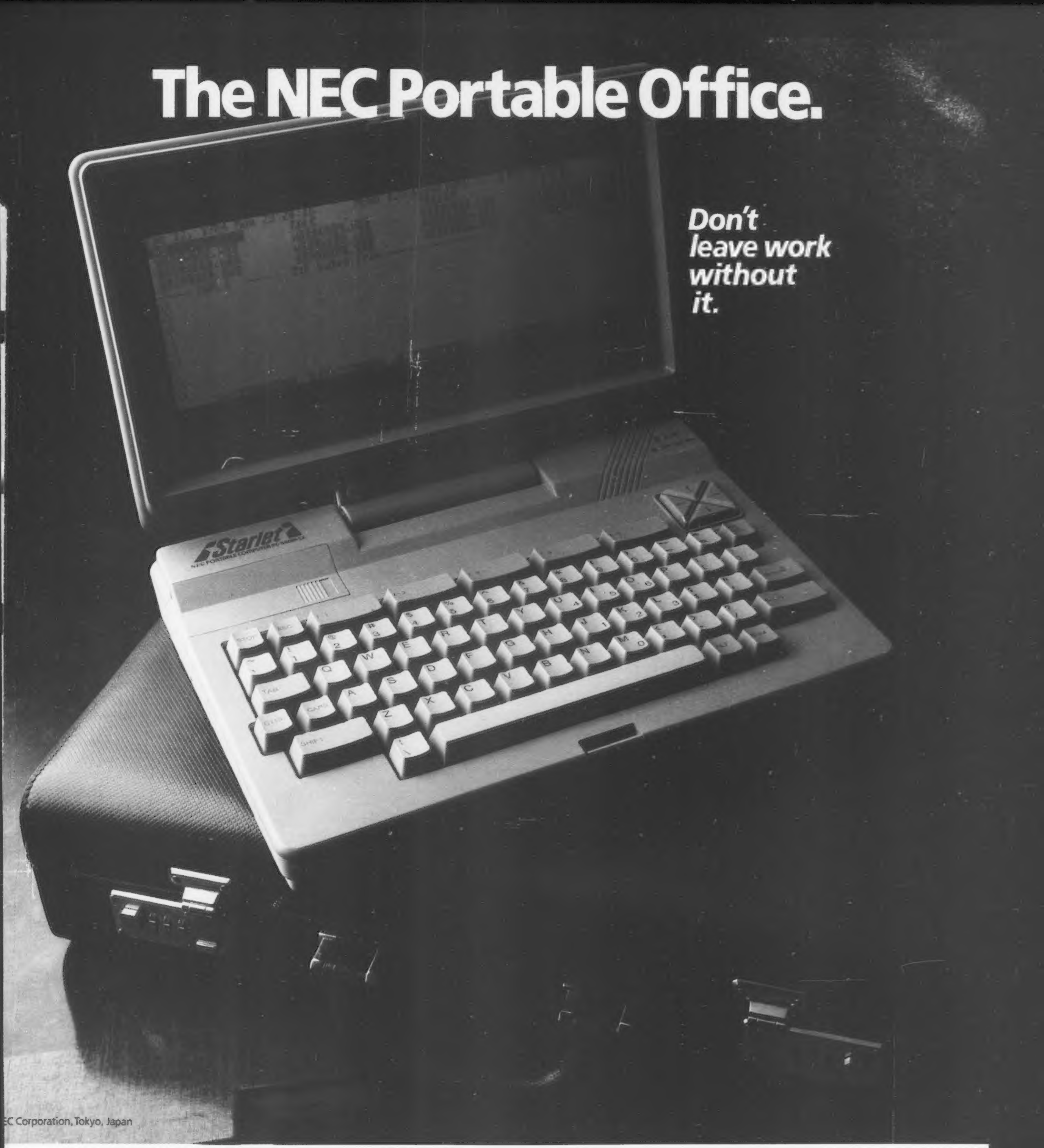
Figure 7. Unlike impact dot matrix printers which produce characters with one pass of the printhead, the Canon Ink Jet printhead must make seven bi-directional passes to create a line of text characters.



The Canon PJ-1080A ink-jet printer does a fine job with color graphics, but it is a long way from producing near-letter-quality text.

Figures courtesy Canon, Inc.

Photography by Jeff MacWright.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CIRCLE 146 ON READER SERVICE CARD

Monitor Update

More monitors for your viewing pleasure/**Russ Lockwood**

In the February 1985 issue, we ran "Choosing an RGB Monitor," an explanation of how RGB monitors operate, a Basic program to torture test a monitor, and capsule evaluations of five RGB monitors. This month, we look at several RGB monitors and take a peek at composite color monitors that use separated video inputs.

Sony KV-1311CR

Most people think of Sony as the manufacturer of the Trinitron line of quality television sets. What you may not know is that Sony also manufactures a computer (the SMC-70) and a line of RGB monitors ranging in size from 9" to 25" diagonal. Now Sony is expanding its electronics horizon by offering the KV-1311CR, a combination RGB monitor, composite color monitor, and television set.

The 13" monitor comes with built-in RGB interface circuitry for the IBM PC/XT/AT/PCjr computers. Special cables, available from Sony, are required to attach the monitor to the computer. Text resolution is 25 lines of 80 characters, and graphics resolution is 640 x 200 pixels (black and white) and 320 x 200 pixels (four-color). The dot pitch is a sharp 0.37mm. The monitor passed our grid and inverse box torture tests with flying colors.

As a television set, the KV-1311CR supports VHF channels 2-13, UHF channels 14-69, and cable channels 1-125. Sony includes a battery-powered remote control unit with on/off, channel, volume, and picture brightness controls; attachable feet to change the angle of the screen; a plug-in earphone; and two-batteries for the remote control unit.

The cylindrical Microblack tinted screen for "minimum reflection" is a mixed blessing. On the positive side, ceiling light reflects downward, away from your eyes. If you work in an office, this reduces wear and tear on your eyes. On the negative side, light streaming over your shoulder scatters over the highly-polished screen, forming an impenetrable glare. Carefully analyze your lighting conditions when you consider the KV-1311CR.

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Three monitors deserving your attention are, from top to bottom, the Teknika MJ-10 (composite with separated video inputs), Sony KV-1311CR (RGB that doubles as a television set), and Zenith ZVM-133.

The monitor stands an inch or so higher than the IBM monitors. If you place the monitor directly on the desk, the Sony offers a good viewing angle. If you place it atop the system unit, plan on lifting your line of sight a bit.

As a television set, the KV-1311CR is excellent. Trinitron quality delivers a superb picture, and the remote control may save you from ever having to watch another idiotic commercial, since you can zap around the dial and change volume without leaving your chair.

Overall, the $595 KV-1311CR earns excellent marks as a television and a monitor. The colors are true, the picture sharp, and the Sony name practically guarantees a long life. Our only reservation is lighting. The highly polished screen can be as much a nemesis as an ally.

Sony, Sony Dr., Park Ridge, NJ 07656. (201) 730-1000.

CIRCLE **408** ON READER SERVICE CARD

Zenith ZVM-133

Zenith is another television manufacturer branching out into the computer world. Does the quality go in before the name goes on? For the ZVM-133 RGB color monitor, the answer is yes.

The ZVM-133 uses a nine-pin D shell connector to attach to an IBM PC or Zenith Z-151 computer. The 13" monitor has a graphics resolution of 640 x 200 pixels (black and white) or 320 x 200 pixels (four-color). The dot pitch is 0.41mm, slightly better than the IBM PC Color Display, and the text resolution is 25 lines of 80 characters.

Photography by Jeff MacWright.

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The torture test proves the ZVM-133 is an excellent monitor. The grid does not waver, and the inverse boxes remain straight and sharp. Give Zenith credit for bringing its television expertise into the monitor market.

The colors are bright and true. We ran a variety of software, from business programs to arcade games, and in each case, the colors appeared sharp and distinct.

The ZVM-133 includes a special green-screen-only button, which effectively turns your RGB color monitor into a monochrome monitor. For text-only work, the green screen is easier on the eyes than color. It is like getting two monitors for the price of one.

At $309, the ZVM-133 is a steal. Although lacking somewhat in physical beauty, the color, resolution, price, and well-known quality make the ZVM-133 RGB color monitor attractive enough to merit serious consideration.

Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025. (312) 391-8949. CIRCLE **409** ON READER SERVICE CARD

Teknika MJ-10

We include the Teknika MJ-10 along with the powerhouse RGB monitors because it uses separated video signals to deliver a teriffic display. It works especially well with Atari computers, although you can hook it up to any computer with NTSC composite output.

The 13" MJ-10 composite color monitor uses a five-pin DIN plug to attach to the Atari. The separated signals (NTSC video, luminence, and chrominance outputs) provide a resolution of 400 lines compared to the 300 lines of regular composite signals. Text resolution is 25 lines of 40 characters. The dot pitch is 0.60mm.

The torture test shows that the MJ-10 can take the video abuse. The grid is straight, and the inverse boxes sharp.

We ran a variety of software on an Atari with the MJ-10. In all cases, the colors were clear and distinct, and the monitor took advantage of the versatility of Atari graphics.

At $299, the Teknika MJ-10 represents a good solid value for the dollar. If you are looking to make the upgrade from a television set to a monitor for your Atari, Commodore, Apple, or other home computer, put the MJ-10 on your list.

Teknika Electronics, 353 Rt. 46 West, Fairfield, NJ 07006. (201) 575-0380. CIRCLE **410** ON READER SERVICE CARD

Three more monitors deserving your attention are, from top to bottom, the Tecmar Color monitor, Princeton Graphic HX-12E, and Amdek Color 500.

Tecmar Color Monitor

The first thing that strikes you about the Tecmar Color Monitor is how closely it resembles the Zenith ZVM-133. It has the same shape, the same knobs, the same green-screen-only button, and even the same connectors. The only difference between the two seems to be the nameplate on the front.

Looking at the back panel reveals that this 13" RGB monitor is indeed manufactured by Zenith, except it is model ZVM-136B. Rather than repeat ourselves, let us just say that the results of tests (using a standard IBM Graphics board) on the Tecmar Color Monitor duplicate the results obtained with Zenith ZVM-133.

So what is the difference? Plenty.

The Tecmar Color Monitor supports the new crop of higher-resolution graphics boards. It achieves a resolution of 720 x 480 pixels with four colors and 640 x 400 with 16 colors. The dot pitch is 0.43mm. Tecmar recommends their own Graphics Master board to obtain the highest resolution possible.

The $795 pricetag is competitive, providing you need the enhanced resolution offered by the monitor. And with the Zenith, ooops, Tecmar label, you know the quality goes in before the name goes on.

Tecmar, 6225 Cochran Rd., Solon, OH 44139. (216) 349-0600.

CIRCLE **411** ON READER SERVICE CARD

Amdek Color 500

Amdek has long provided quality monitors, and the Color 500 lives up to the tradition. Like most electronics goods these days, this 13" monitor is made in Japan. It offers two modes of video input—NTSC composite color and RGB color.

The Color 500 uses a 9-pin D shell connector to attach to an RGB port. It has a graphics resolution of 560 x 240 pixels in RGB mode and 320 x 240 pixels in composite mode. The dot pitch is 0.51mm, which is not as good as the 0.43mm of the IBM PC Color Display, and the text resolution 25 lines of 80 characters.

The torture test proves the Color 500 to be quite good. The grid remains rock solid, and the inverse boxes remain straight and true. The only nitpicking we can do is to point out that the border registers a slight bowing at the bottom right corner. This curvature affects only the border and not the main screen area.

We ran a variety of software with the monitor hooked into a Leading Edge PC for RGB input and an Apple IIc for composite input. In all cases, the colors appeared sharp and distinct.

The Color 500 includes a special green-screen only button, which effectively turns color into monochrome and makes text work easier on the eyes.

Amdek offers a truly versatile color monitor in the Color 500, but it is not exactly for the IBM PC, XT, or AT. It attaches to and works fine with a PC, but an Amdek spokesman noted that it is primarily for the Apple II and IBM PCjr computers. By providing both composite and RGB color, it allows two computers to share one monitor. Indeed, it even has a switch on the back to change between computers without plugging and

Photography by Jeff MacWright.

unplugging the cables. And with a price of $450, the Color 500 is relatively easy on the budget.

Amdek, 2201 Lively Blvd., Elk Grove Village, IL 60007. (312) 595-6890. CIRCLE **412** ON READER SERVICE CARD

PGS HX-12E

Princeton Graphic Systems offers a line of high-resolution RGB monitors tailored for IBM PC and compatible systems. The HX-12E is an enhanced version of the company's initial product, the HX-12. The big improvement is that it can be used with either the regular IBM color graphics board or the newly-introduced IBM Enhanced Color Graphics Adapter.

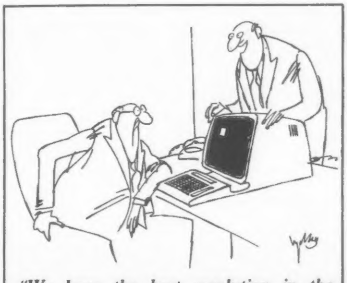
The 12" HX-12E displays 16 colors with a resolution of 640 x 200 pixels at 15.75 KHz (the regular graphics board) or 64 colors with a resolution of 640 x 350 pixels at 22 KHz (the Enhanced Color Graphics Adapter). The dot pitch is a super-sharp 0.28mm—much, much better than the 0.43mm of the IBM Color Display.

Thus, it should not be a surprise to learn that the HX-12E passed our monitor torture test (using the regular graphics board). In fact, this is an exceptional monitor. Even the text resolution of 25 lines of 80 characters proves to be superb. We quickly switched over from the IBM Color Display to the PGS HX-12E.

Of course, high resolution commands a high price. At $785, the HX-12E is certainly not cheap. In fact, it represents overkill when used with a regular graphics board. However, if you plan to purchase the IBM Enhanced Graphics Adapter, by all means head straight for a PGS dealer.

Princeton Graphic Systems, 170 Wall St., Princeton, NJ 08540. (609) 683-1660, (800) 221-1490. ■

CIRCLE **413** ON READER SERVICE CARD



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HomeMinder is available in two versions—a free-standing unit that connects to any TV set (or monitor) and a unit built into a 25" component TV set. We tested the free-standing version and seven assorted control modules.

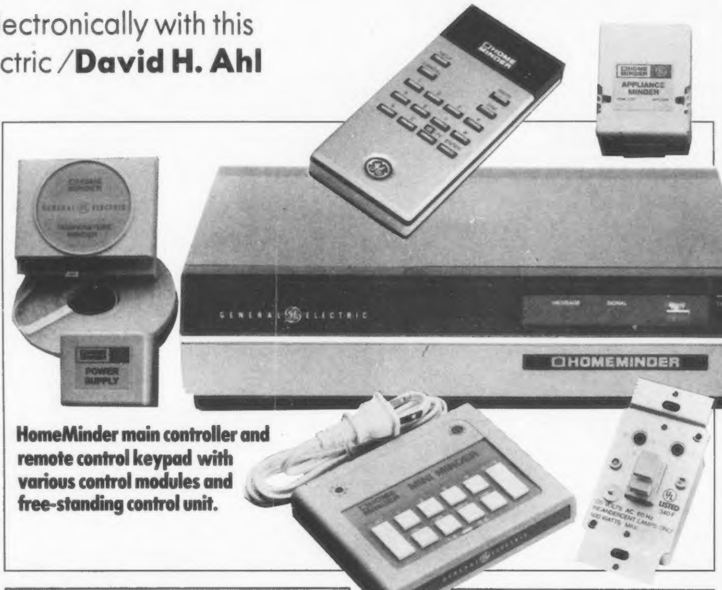
The main controller comes packaged with a remote transmitter, one lamp module, one appliance module, and appropriate TV and telephone cables. Also available are extra modules, a light switch module, thermostat controller, and remote control unit.

Simple Set Up

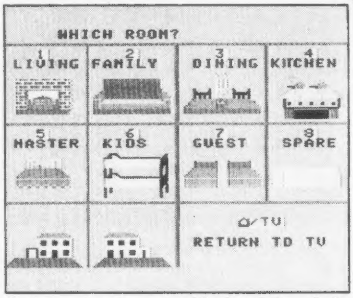
The main controller connects between your TV set and antenna (or cable, VCR, computer, etc). It has both VHF (Ch. 3 or 4) and NTSC video output. There are no controls on the main controller itself; once plugged in, it is always on awaiting a command from the infrared remote control keypad.

The keypad has 16 keys (ten numbers, TV/HomeMinder switch, Enter key, Help key, Cancel key, and two keys to brighten or dim lamps). Once the main controller is installed, it leads you through a pictorial dialogue to set the time and date, install the module for each lamp or appliance, set on and off times, and set lamp brightness. The on-screen dialogue is especially helpful as you simply choose from a series of pictures the type of lamp or appliance you want to install, the room it is to go in, and the location in the room. You can set up to 96 on/off times for each unit (two or three should be plenty). Times can be set exactly or using "security" mode (turns on or off within 60 minutes of the time set). Devices can also be set to function every day, on weekdays, weekends, or specific days.

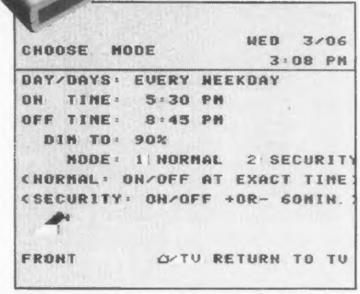
Each lamp or appliance module plugs into a polarized outlet (one prong is bigger than the other), and the lamp or appliance plugs into the module. These modules are identical to those sold by BSR, Leviton, Sears, and Radio Shack, although a GE spokesman told me that theirs are made to more exact specifications. As all five are made in Malaysia, this seems improbable. We tried the GE system with a combination of GE, Leviton, and BSR modules and everything worked fine.



HomeMinder main controller and remote control keypad with various control modules and free-standing control unit.



System set-up is easy with pictorial symbols.



```
                                WED  3/06
CHOOSE  MODE                     3:08 PM
DAY/DAYS: EVERY WEEKDAY
ON  TIME:  5:30 PM
OFF TIME:  8:45 PM
  DIM TO: 90%
     MODE: 1 NORMAL  2 SECURITY
<NORMAL: ON/OFF AT EXACT TIME>
<SECURITY: ON/OFF +OR- 60MIN.>

FRONT            ⌂/TV RETURN TO TV
```

Dialogue to set-up outdoor spotlight.

Telephone and Memo Operations

To control a device remotely, you can call your home phone from a touch tone phone. HomeMinder will answer after seven to ten rings with three beeps. If you have chosen to use a password (actually a three-digit number), you key that in followed by the code number of the device you wish to turn on or off.

You can also leave simple messages in the form, "I will be home at (time)" or "Call me at (phone number)."

Is It Worth It?

HomeMinder retails for about $500 with an assortment of seven or eight modules. Is it worth $300 more than a similar non-televised BSR/Leviton/etc. version? Yes, if you need the remote telephone facilities. Yes, if you want to set different times for weekdays and weekends. Yes, if you want especially easy programming. And, yes, if you want to be the first on your block with the latest high-tech gizmo. If not you can achieve the same control and security functions for a fraction of the price—but it won't be nearly as much fun. ■

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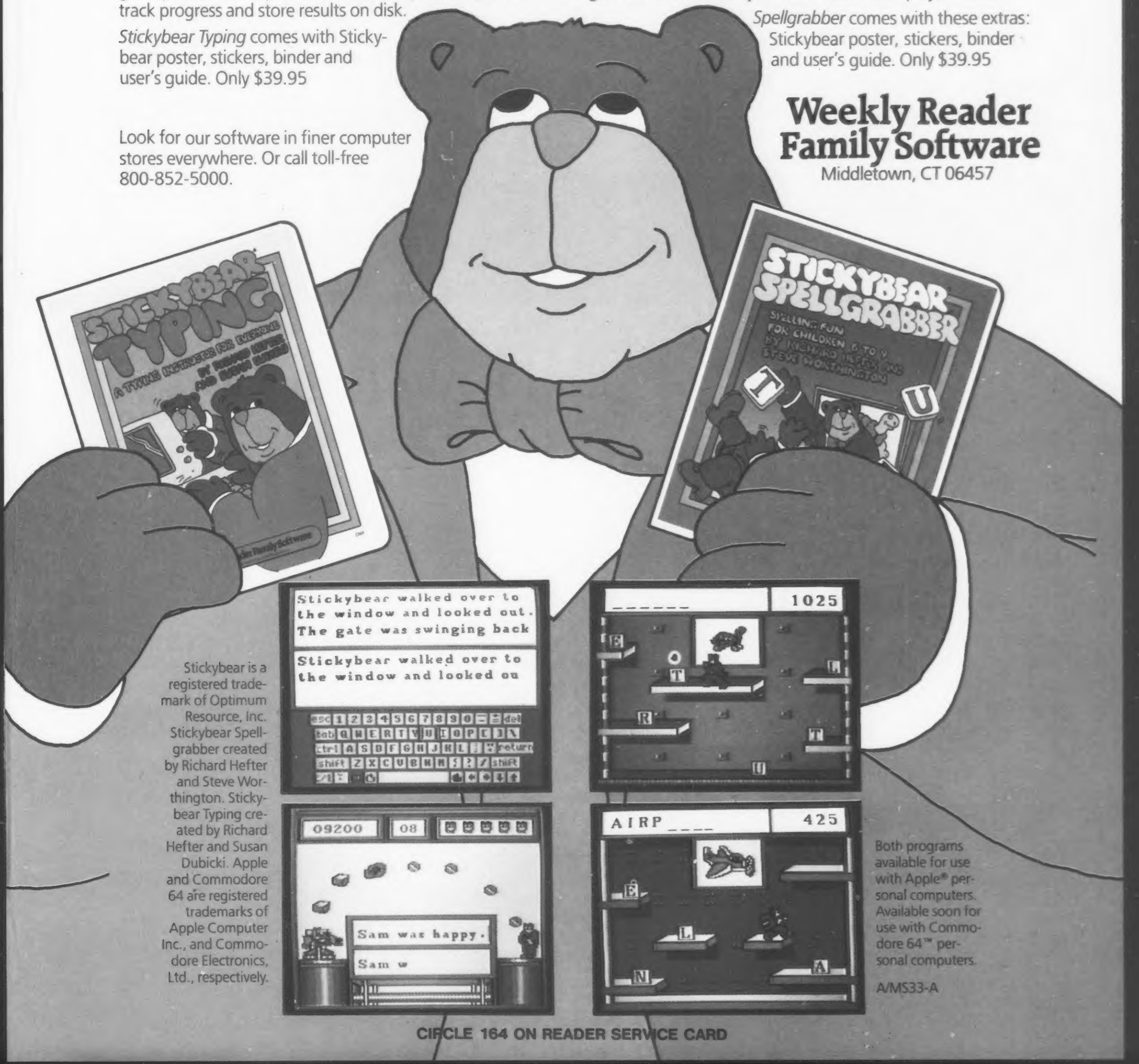
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T
U
1025
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09200
08
AIRP____
425
E
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N
A

Stickybear walked over to the window and looked out. The gate was swinging back

Stickybear walked over to the window and looked ou

Sam was happy.

Sam w

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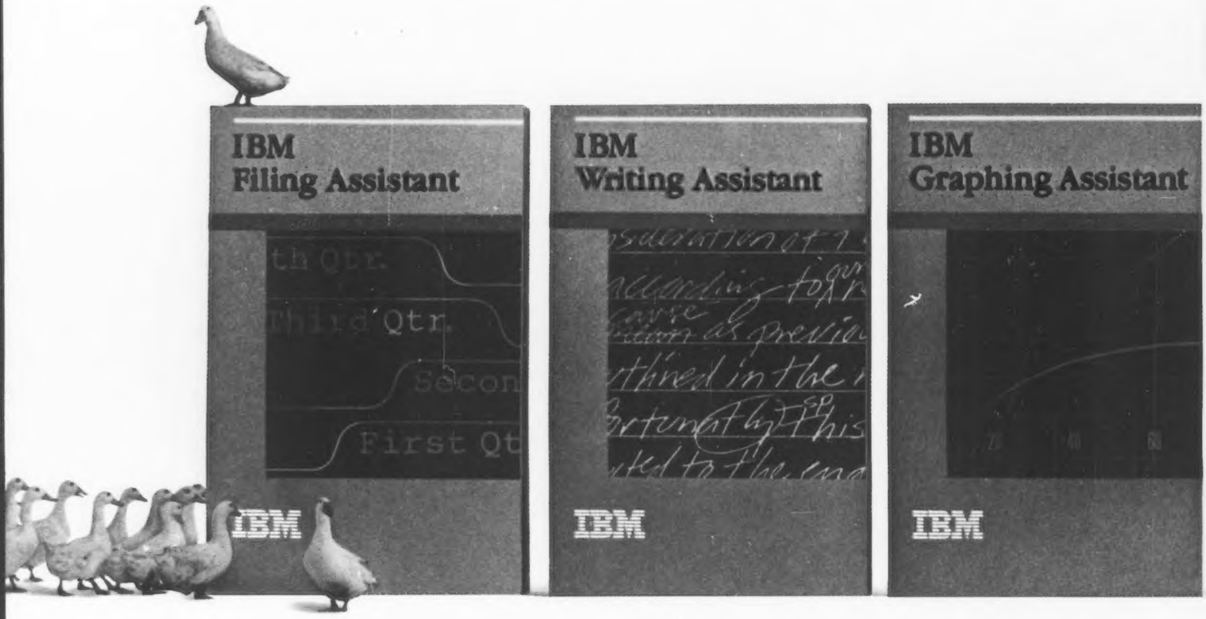

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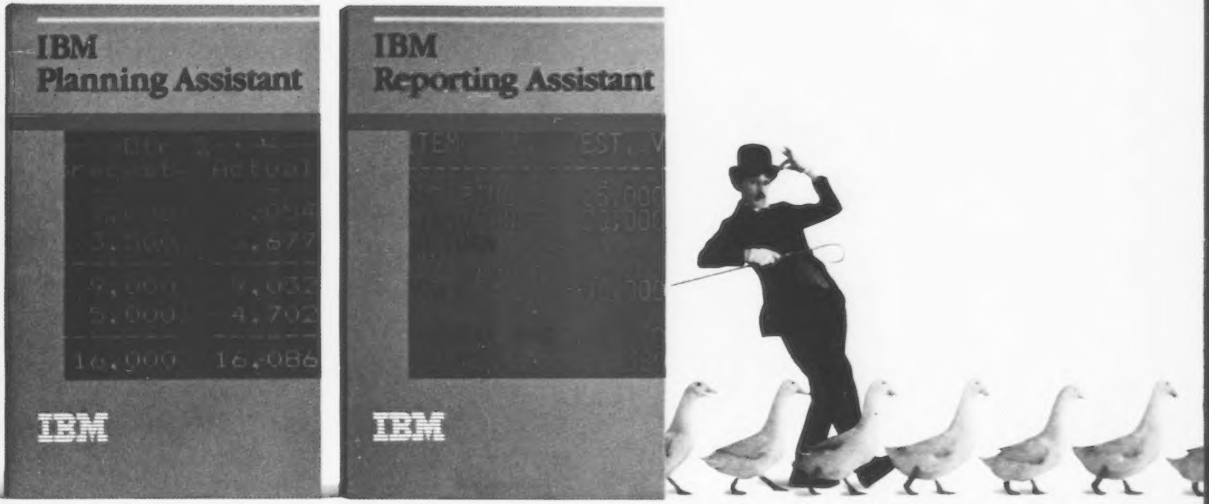

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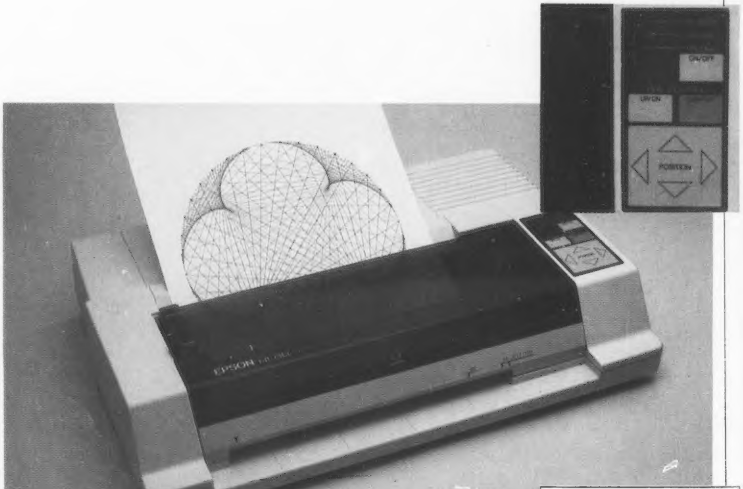
Epson HI-80

A versatile, accurate, four-color plotter at a surprisingly modest price/**David H. Ahl**



Hardware Profile

Name: Epson HI-80 **Type:** Moving paper plotter **Interface:** Parallel
Paper size: 8 1/2" x 11" **Plotting area:** 7.6" x 10.5"
Resolution: 0.004" **Repetition accuracy (different pen):** 0.012"
Dimensions: 16.3" x 10.8" x 3.1" **Price:** $599
Manufacturer: Epson America, Inc.
3415 Kashiwa St.
Torrance, CA 90505
(213) 539-9140

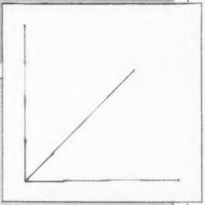


Figure 1. Repetitive pen accuracy is within 0.3mm (0.012")

The HI-80 plotter epitomizes the Epson tradition of offering well-designed, reliable products at a modest price. The HI-80 handles paper up to the European A4 size (slightly larger than U.S. letter size) and has a plotting area of up to 267mm x 192mm (10.5" x 7.6"). Up to four colors can be used on one plot. The plotter uses a standard parallel interface, thus eliminating the need to fool with RS-232 cables, DIP switches, and matching parameters.

The plotter is about the size of a dot matrix printer (16.3" x 10.8" x 3.1"). On each side a serrated metal paper roller and rubber wheel grip the paper and move it back and forth (along the long dimension) while the pen holder moves from right to left (along the short dimension). This mechanism leaves a barely noticeable perforation in the paper. The plotter works with either plain paper or film (for overhead projectors). Three types of pens are available, each in ten colors: the standard fiber tip (draws about the width of a Pilot Razor Point), ballpoint (for a finer line), and fiber tip with an oil-based ink (for drawing on film).

Repetitive accuracy of pen movement is specified to be better than 0.3mm for a single pen and 0.5mm for different pens. In our tests, actual accuracy was considerably better than these figures. According to Epson specifications, a fiber pen should draw 200 meters over its life (400m for ballpoint and oil-based fiber tip). We did not check these figures, but have no reason to doubt them.

The plotter has three modes of operation. Mode 0 is the normal plotter mode and uses 42 two-letter commands. Mode 1 is a more basic plotter mode and uses 18 single-letter commands. Printer mode simulates a printer and has 38 commands for producing text in various typefaces and styles. It is possible to produce text in Modes 0 and 1 as well, although for extensive text on a chart, it is probably most sensible to do the chart in Mode 0 or 1 and add the text in printer mode.

In addition to the on-line modes, the HI-80 has a self-test mode which checks the control and mechanism functions and the drawing quality.

The plotter has only a few controls. An on/off switch is located on the right side, while touch sensitive switches for on/off line, pen up/down, pen cap on/off, and pen position are found on top. Three LED's indicate power on, on-line, and error condition. Unfortunately, once an error occurs, there is no way to recover from it short of turning the plotter off and back on. This makes program debugging somewhat tedious, particularly in the beginning when there are likely to be numerous errors.

A plotted point in either the x or y direction is equal to 0.01mm; thus there are 2670 points in the x direction and 1920 points in the y direction. These points may be located within a virtual plotting area ranging from –32768 to 32767 depending upon where you locate the origin. The plotter has no automatic scaling capability; all scaling must be done within the program.

All commands are sent to the plotter using the LPRINT statement. Com-

Photography by Jeff MacWright.

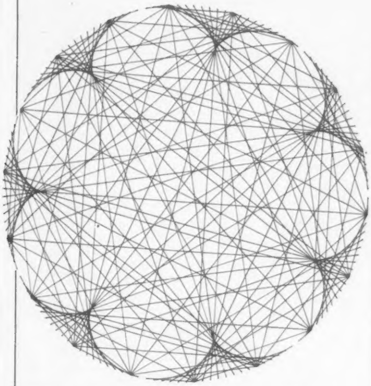


Figure 2. HI-80 manual has program to produce patterns of this type.

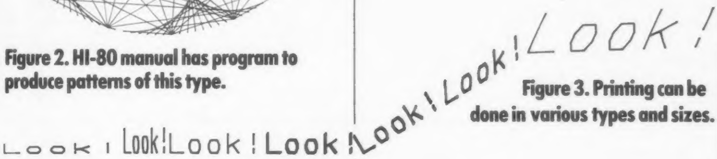

Look ! Look! Look ! Look ! Look ! Look ! Look ! Look !

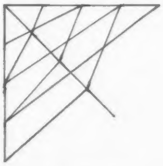
Figure 3. Printing can be done in various types and sizes.

mands in both plotter modes include the expected move and draw from an absolute point, move and draw relative to the last pen position, and go home. There are commands to draw axes, graph markers, and eight types of lines. Printing can be added to charts in various directions and sizes, pen number and speed specified, and the plotter buffer cleared.

Mode 0 has 24 additional commands for moving the pen to the origin, altering the drawing window in the virtual plot area, setting an enlargement factor (a crude way of scaling), drawing circles and arcs, drawing smooth curves between a series of points, and drawing arrows, grids, cross hatching, and pie segments. This mode offers a wider variety of text features than Mode 1; they include emphasized, slanted, vertical offset, and rotation. In all, the HI-80 has more commands available than any other plotter in this price range. One of the only commands missing is one to draw ellipses or ellipse segments, but this is rarely found on plotters costing under $2000.

The commands in the printer mode practically duplicate those of a full-featured dot matrix printer including normal type, italics, double-strike, enhanced (second stroke slightly offset from first), superscript, and subscript. Character height, width, and slant can be set as well as line spacing, margins, and tab stops. You would not, however, want to use the HI-80 in place of a printer; although the results are excellent, it is slower than the slowest dot matrix printer. Its printing capability should be reserved for charts and overhead projector transparencies.

We tried producing a variety of mathematical and business charts on the HI-80 and were very pleased with the results. The commands were easy to learn and, except for the annoyance of having to enclose every individual comma in parentheses, easy to use. (Houston Instruments' approach of letting a space represent a comma—with or without parentheses—makes entering and reading plotter code much easier.)



```
10 ' Check pen accuracy
20 FOR I=1 TO 4
30 LPRINT "SP";I
40 X=0:X1=0:Y1=100*I:Y=Y1-100
50 GOSUB 130
60 Y=0:Y1=0:X1=100*I:X=X1-100
70 GOSUB 130
80 X1=71*I:Y1=X1:X=X1-71:Y=X
90 GOSUB 130
100 NEXT
110 LPRINT "DF"
120 END
130 LPRINT "MA";X;",";Y
140 LPRINT "DA";X;",";Y;",";X1;",";Y1
150 RETURN
```

Figure 4. Pen accuracy program listed in printing mode.

The fat 305-page manual is very thorough and even goes so far as to include an example of plotting a graph using *SuperCalc* (other spreadsheets would be similar). A minor nit is that line 150 of the Line Drawing Program on page 7-12 should use the COS function rather than the SIN function as printed; but that will be evident soon enough if you enter the program as written, because it won't work.

All in all, the Epson HI-80 is a remarkable performer at only $599. It boasts the most complete set of plotter commands in its price range, offers excellent accuracy, is easy to learn and use, and, if it is built like other Epson products, will have high reliability as well. ■

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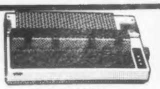

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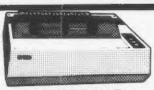

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Leading Edge Word Processing

Upgraded version packs power and features/**Russ Lockwood**

In the word processing market where giants like *WordStar*, *MultiMate*, and *Word Perfect* battle for corporate accounts, *Leading Edge Word Processing* wages an almost guerrilla war. It was once considerably more expensive, but evidently did not generate enough sales at that price level, for Leading Edge cut the price. And now the company has improved and refined the product, making it one of the better software values around.

Leading Edge Word Processing (or *LEWP* as it is called in the manual) includes all the features and functions you expect of a good, solid word processing program: insert, delete, block operations, search and replace, file merge, boldface, underlining, super- and subscripts, justification, headers, footers, centering, adjustable margins, and full cursor movement.

Like many other word processors, *Leading Edge* uses a combination of Control, Alternate, Shift, Function, and Cursor keys to invoke various functions. A plastic template that fits around the keyboard provides an instant summary of commands. A remarkably easy-to-understand reference card provides a quick summary of the procedures used for executing functions. On-line help screens furnish even more detailed information. For particularly troublesome functions, the recently redesigned manual supplies step-by-step instructions. And if a particular command still manages to baffle you, Leading Edge maintains a toll-free hotline to provide the definitive solution to your problem.

Obviously, Leading Edge takes great pains to reduce potential problems in understanding *LEWP*. During our testing, we managed to effect most functions just by looking at the template and quick reference card. Some of the trickier functions required a peek at a help screen or inside the manual. Overall, we give the documentation very high marks.

LEWP also includes several features that separate it from other medium-price word processors. New users may not appreciate them at first, but the more word processing you do, the happier you will be to find these features included in *LEWP*.

Leading Edge Word Processing

(–) (+)
PERFORMANCE

(–) (+)
EASE OF USE

(–) (+)
DOCUMENTATION

(–) (+)
UTILITY

(–) (+)
OVERALL VALUE

System and Price: 256K IBM PC, $100; with merge print, $150; with merge print and spelling checker, $250

Summary: At $100, one of the best word processing values around

Manufacturer:
Leading Edge Products
21 Highland Circle
Needham Heights, MA
02194
(617) 449-4655
(800) 343-3436

LEWP allows user-definable format styles. Each folder uses a standard document. Altering the standard document automatically alters all the files in the folder. Default settings include tabs, margins, headers, footers, and more. If you use standardized formats for memos, proposals, and other correspondence, this feature can be a godsend.

The program also includes macros—defining one key to print a string of characters.

It also lets you restore deleted text on two levels. On a short-term basis, *LEWP* allows the most recently erased text to reappear. However, on a long-term basis, it stores deleted blocks of text on disk, so you can recall them hours, days, or even weeks later. Of course, deleted text takes up disk space, but if you have ever pined for a bit of prose erased in haste and reconstructed at leisure, you will appreciate this uncommon feature.

LEWP Does Windows

If you ever want to work on two documents at once, a split screen feature is necessary. *LEWP* includes this function and allows you to switch windows with the press of a key.

Another handy feature is the ability to use the entire 255-character IBM PC character set (including graphics, scientific, and foreign characters) by pressing the Alternate key and then typing the number of the character on the keypad.

LEWP also converts document files to ASCII so you can send them over the phone lines using a telecommunications program.

LEWP supports a variety of printers, including C. Itoh, NEC, Diablo, Qume, Juki, Okidata, Star Micronics, and Texas Instruments. All printer drivers are on disk, so it is a simple matter of picking and choosing.

In an earlier version, one idiosyncrasy marred this otherwise excellent word processor: Leading Edge decided to use the + key on the numeric keypad instead of the Return key to "execute" most of the functions. For those who have never used a word processor, this is not a problem. However, those for whom the Return key is ingrained in the subconscious will find this + key downright frustrating. By the time you read this, Leading Edge will have fixed this problem. Make sure that the version you purchase uses the Return key to execute functions.

For $50 more, *LEWP* users receive Merge Print, a handy mail merge feature for businesses that want to send "personalized" mass mailings. The home user can probably get by without it, unless you do Christmas card mailings or something along that line. Merge Print supports *dBase II* files.

The complete word processing system, including *LEWP*, mail merge and spelling checker, retails for $250. The spelling checker holds 80,000 words and allows a personal dictionary of 4000 words on a floppy disk. Frankly, Leading Edge loses some of its price advantage when the $100 spelling checker is added. Still, the package costs less than other top-of-the-line word processors with the same features.

Overall, we are impressed with the features and performance of *Leading Edge Word Processing* and recommend that prospective purchasers of a word processor take a close look at this comprehensive program. Although geared for the professional and business crowd, *LEWP* should not be overlooked by home computer owners. ■

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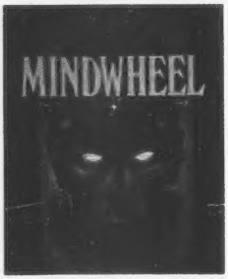


Mindwheel

(–) (+)
PLAYABILITY
(–) (+)
CHALLENGE
(–) (+)
ADDICTIVENESS
(–) (+)
EASE OF LEARNING

System and Price: IBM PC, Apple II, Macintosh, $44.95; C64, Atari $39.95

Summary: Excellent adventure game

Manufacturer:
Synapse
5221 Central Ave.
Richmond, CA 94804
(415) 527-7751

CIRCLE **418** ON READER SERVICE CARD

The world teeters on the brink of destruction. The future points toward nuclear annihilation, and the past lies forgotten in the march of time. No one can turn back the clock. Death appears certain—unless you can travel telepathically back to the germination of civilization and retrieve the Wheel of Wisdom, a "mysterious object that contains the secret of your planet's best values."

You see, a mind is a terrible thing to waste, and Nature never wastes anything. Thought patterns of a mind—the soul, if you will—are trapped within the neuro-electronic matrix of time and space. Corporeal death translates into mental immortality. The more powerful the mind, like an Einstein, a Shakespeare, or even a Hitler, the more accessible within the matrix.

Your mission is to journey into the matrix, tame four of the most powerful minds (a scientist, a poet, a dictator, and a rock star) in history, and wrest the Wheel of Wisdom from the ageless Cave Master.

Written by Robert Pinsky, poetry editor for *The New Republic*, this text-only adventure game propels you through a bizarre series of puzzles and encounters. Like a cross between Dante's *Inferno* and a Kurt Vonnegut novel, the prose remains engaging, imaginative, and provoking throughout—a testimony to using real authors rather than programmers to write adventure games.

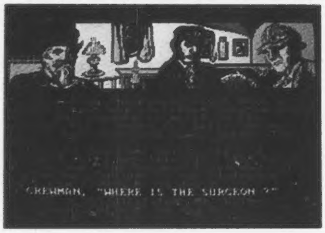
The game comes with a 93-page hardcover book that provides an introduction to the adventure. About 20 pages are blank ("adventurer's notes"). The anti-piracy scheme is well-done: the program requires a password, which is a certain word on a certain line on a certain page in the book. This password changes with each play, rendering the disk useless without the book.

Synapse (Broderbund) calls *Mindwheel* an "electronic novel." We call it an enchanting adventure game featuring deathless prose, an intriguing plot, and a solid parser structure.—*RSL*

"I say Watson, here we are aboard the luxury liner S.S. Destiny with a passenger list of celebrities that would put the Love Boat to shame. It is the summer of 1919 and I should be tending my bees, or at least enjoying the cruise. Unfortunately, a mysterious note arrived that required my presence aboard this ship. This case smacks of Prof. Moriarity, if he were still alive. And what of the apparent suicide of General Ryan, and the tie in with a poorly translated poem? Watson, hand me my pipe and magnifying glass. I may be old and my eyesight dimmed, but someone has taken the trouble to assemble all of us on this ship, and I intend to uncover who—and why."

Sherlock Holmes places you in the shoes of the world famous detective. Using your powers of deduction and an occasional hint from your everpresent sidekick Watson, you must unravel the threads of no less than six intertwined cases in this challenging adventure game.

Sherlock Holmes



CREWMAN, "WHERE IS THE SURGEON ?"

(–) (+)
GRAPHICS
(–) (+)
PLAYABILITY
(–) (+)
CHALLENGE
(–) (+)
ADDICTIVENESS
(–) (+)
EASE OF LEARNING

System and Price: IBM PC/PCjr, Apple II, C64, Macintosh; $39.95-$44.95

Summary: Good fun for amateur sleuths

Manufacturer:
Bantam Electronic Publishing
666 5th Ave.
New York, NY 10103
(212) 554-9832
(800) 223-6834 x832

CIRCLE **419** ON READER SERVICE CARD

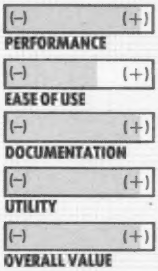
The cast of characters is immense: Sir Arthur and Lady Conan Doyle, Henry Ford, Baron Lionel Walter Rothschild, Picasso, Col. T. E. Lawrence (of Arabia), Mr. and Mrs. Thomas Alva Edison, Mr. and Mrs. Alexander Graham Bell, Mr. and Mrs. Harry Houdini, and a host of others. Just figuring out who is who will take some time.

Fortunately, *Sherlock Holmes* comes with a map of the ship and Watson's notes on every person of importance. The 2000-word interactive vocabulary and commendable parser structure assure that you can observe and question the passengers. Whether any of this close-mouthed lot will answer is another thing.

The story line provides plenty of Holmesian mystique: shadowy figures at night, eccentric celebrities, apparent accidents, suspicious actions, and a multitude of clues that can be more baffling than beneficial.

Sherlock Holmes fans and amateur sleuths will enjoy this complex adventure. However, many will find the tight-lipped and elusive passengers too tough to crack. In the end, the solution rides on your persistence and deductive reasoning. After all, it is elementary, my dear Watson.—*RSL*

Cornerstone



System and Price: 256K IBM PC; $495

Summary: Flexible, full-featured DBMS has some quirks

Manufacturer:
Infocom
125 Cambridge Park Dr.
Cambridge, MA 02140
(617) 492-6000

CIRCLE **420** ON READER SERVICE CARD

Infocom, the preeminent publisher of interactive fiction (formerly known as adventure games), is invading the business market with *Cornerstone*, which it touts as "the sophisticated database system for the non-programmer." However, although overflowing with the features and functions you would expect in a relational database management system (DBMS), *Cornerstone* has some unpleasant aspects as well.

A single *Cornerstone* database can hold up to 120 files, and each file holds up to 8 million characters. Each record in a file is comprised of up to 160 fields totaling no more than 4000 characters, although this can be expanded through the use of subrecords. All records are variable length—the program uses only as much storage space as needed.

Each field holds a specific data type. For example, a numeric data type holds only numbers and provides up to 15 decimal digits of precision. A string data type holds up to 255 characters. An especially useful data type, called "derived," performs arithmetic, statistical, and financial functions just like a spreadsheet.

Perhaps the most sophisticated—and useful—feature of *Cornerstone* is "multivalued attributes." This allows a single field to hold several entries. For example, if you are tracking a company, you can create a field named "contacts" and then list several people. Even better, you can go back and add more people to the field at any time.

The text editing function supports word wrap and automatically opens up lines when needed. Individual fields can be created and deleted at any time. The program also provides complex search criteria including wildcards, ranges, exact matches, and the logical operators AND, OR, and NOT.

Cornerstone includes a powerful report generator with full-screen design capability. It lets you save up to 255 formats and can transfer data between *MailMerge, Lotus 1-2-3, dBase II, pfs:File*, and other programs using DIF, SDF, and ASCII files.

The tradeoff for this flexibility is speed. DBMs are notoriously slow, and *Cornerstone* is no exception. A hard disk system is definitely recommended for both speed and storage capacity.

Cornerstone is menu driven, although advanced users can take advantage of several shortcuts to invoke functions. Unfortunately, using *Cornerstone* menus is a lot like navigating through the underground caverns in *Zork*: you get lost, confused, trapped, and frustrated. The menu terms are sometimes ambiguous, and invoking some functions requires more intuition than intelligence.

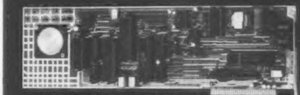
Comprehensive on-screen, context-specific help and an excellent set of manuals ease the pain of learning *Cornerstone*. A Beginner's Guide leads you through a 10-lesson tutorial.

Customer support starts out well for the first 90 days, offering free telephone hotline support (you pay for the call) and free replacement of defective disks. After that, you are on your own. However, for a steep annual fee of $150, the extended support plan provides free program upgrades and up to five problems (Infocom calls them "incidents") solved by customer support. You pay for the call and for subsequent incidents.

Overall, *Cornerstone* is a well-conceived database system packed with features. It has several drawbacks that prevent us from giving a blanket recommendation, but its flexibility, marvelous multivalued attributes, and outstanding report generator make it a top contender in the DBMS marketplace.—*RSL*

FASTER

USRobotics' swift new Courier 2400™ modem cuts data transmission time in half, decreasing phone costs and increasing productivity. The auto-dial, auto-answer Courier adjusts itself from 2400 to 1200 or 300 bps. And if you prefer an internal slot modem for IBM-PCs or compatible computers, the Microlink 2400™ gives you the same great features at the same great price. Courier and Microlink 2400 modems. They're going fast.



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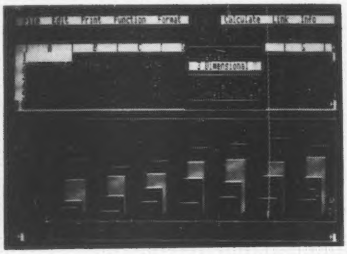
CIRCLE 118 ON READER SERVICE CARD

Mouse Calc



(–) (+)
PERFORMANCE

(–) (+)
EASE OF USE

(–) (+)
DOCUMENTATION

(–) (+)
UTILITY

(–) (+)
OVERALL VALUE

System and Price: Apple IIc or 128K "enhanced" IIe with one drive (two recommended) and mouse; $149.95

Summary: Powerful, yet easy to use thanks to the mouse-user interface

Manufacturer:
International Solutions
910 W. Maude Ave.
Sunnyvale, CA 94086
(408) 773-0443

CIRCLE **421** ON
READER SERVICE CARD

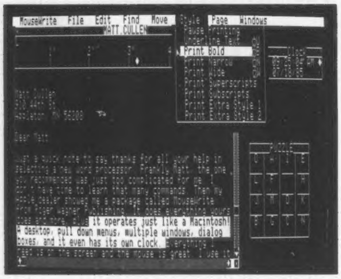
Mouse Calc is a delightfully easy-to-use spreadsheet package designed for novice and intermediate Apple II users. Unlike most spreadsheet programs, *Mouse Calc* makes extensive use of the mouse-user interface with its pull-down menus and flexible windows, as opposed to the sometime-cryptic commands and hefty manuals that seem to have become commonplace.

Originally released in France under the name *Version Calc*, *Mouse Calc* has been brought to and translated for the United States by International Solutions, a trading company located in Sunnyvale, CA. The *Mouse Calc* spreadsheet consists of 63 columns by 254 rows for a total of 16,002 cells (every bit as large as the popular *SuperCalc3a*). Each cell can hold an alphanumeric label, a numeric constant, or an arithmetic formula based upon the contents of other cells. For example: the contents of cell A2 may be multiplied by B2 and the product placed in C2. The construction of such a formula is as simple as point-and-click thanks to the mouse. *Mouse Calc* users can construct formulas with rounded and formatted results, as well as take advantage of logical functions such as And/Or and True/False.

For the novice, *Mouse Calc* comes complete with a thorough tutorial which painlessly introduces the powerful features of the spreadsheet. After an hour with *Mouse Calc*, even the most timid user can create color bar and line graphs and send them to a printer for hardcopy (*Mouse Calc* supports the Imagewriter and Epson printers). *Mouse Calc* can read files created previously with *VisiCalc, AppleWorks*, and other programs that utilize the standard DIF format.

Mouse Calc is an excellent example of what Apple software will be like in the future—powerful, yet easy to use. Keep your eyes open for new additions to the International Solutions series of mouse-based, integrated applications. —*OWL*

Mouse Write



Matt Cullen
[illegible]
[illegible]

Dear Matt

Just a quick note to say thanks for all your help in selecting a new word processor. Frankly Matt, the one you recommended was just too complicated for me. I don't have time to learn that many commands. Then my Apple dealer showed me a package called MouseWrite from Roger Wagner Publishing. It does everything yours does and more. Plus it operates just like a Macintosh! A desktop, pull down menus, multiple windows, dialog boxes, and it even has its own clock. Everything I need is on the screen and the mouse is great. I use it

(–) (+)
PERFORMANCE

(–) (+)
EASE OF USE

(–) (+)
UTILITY

(–) (+)
OVERALL VALUE

System and Price: Apple IIc and 128K enhanced Apple IIe disk systems; $125

Summary: A full-featured Mac-like word processor

Manufacturer:
Roger Wagner
Publishing, Inc.
10761 Woodside
Ave., Suite E
Santee, CA 92071
(619) 562-3670

CIRCLE **422** ON
READER SERVICE CARD

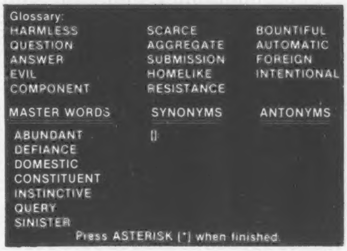
MouseWrite is a Macintosh-like word processor for the Apple II that makes full use of the mouse/window user interface that has proven so successful on the Mac. I was lucky enough to have a prototype version of *MouseWrite* demonstrated to me by Roger Wagner, president of the software publishing company that bears his name.

MouseWrite is very much like *MacWrite*, the word processor bundled with the Macintosh. In fact, *MouseWrite* is one of the first programs that makes full use of the mouse capabilities of the Apple II line. I was initially a bit reluctant to accept the idea of a mouse-driven word processor, feeling that it was awkward to switch from keyboard to mouse every time I wanted to invoke a command. However, this is not how the program is intended to be used. After the initial setup of the system, text is entered directly from the keyboard. Once the document is entered, it is easily edited using the mouse to select commands, print styles, file operations, and page formatting.

MouseWrite, unlike many word processors in its price range, has virtually every feature one could ask for including word count, global search and replace, automatic page numbering, easily embedded control codes, and support of a variety of printers. *MouseWrite* also determines the reading level of your document using an educator's tool known as the Fog Index. Many users will appreciate that *MouseWrite* does automatic time and date stamping of files, even on a IIc or a IIe without a clock card.

MouseWrite supports what Apple calls "mouseless mouse commands" (how's that for Newspeak?). That means that if you don't own a mouse, you can still invoke all of the commands by using the arrow keys in conjunction with ESC. My only complaint about *MouseWrite* is that certain commands, such as deleting characters, are laboriously slow. Nevertheless, I would recommend *MouseWrite* without reservation to anyone searching for a full-featured word processor for use on an Apple IIc or 128K "enhanced" IIe. If you salivate at the thought of owning a Mac, *MouseWrite* may be just the thing to satisfy your hunger for the time being.—*OWL*

Masterword (Wordshark 1-3)



```
Glossary:
HARMLESS            SCARCE          BOUNTIFUL
QUESTION            AGGREGATE       AUTOMATIC
ANSWER              SUBMISSION      FOREIGN
EVIL                HOMELIKE        INTENTIONAL
COMPONENT           RESISTANCE

MASTER WORDS        SYNONYMS        ANTONYMS
 ABUNDANT           []
 DEFIANCE
 DOMESTIC
 CONSTITUENT
 INSTINCTIVE
 QUERY
 SINISTER
        Press ASTERISK [*] when finished.
```

(–) (+)
DOCUMENTATION

(–) (+)
PEDAGOGY

(–) (+)
EASE OF USE

(–) (+)
EXECUTION

System and Price: Apple II; $59.95 each, $159.95 complete set

Summary: An outstanding series of vocabulary building programs

Manufacturer:
Perfection Form Company
1000 N. Second Ave.
Logan, IA 51546
(800) 831-4190
(800) 432-5831 (in IA)

CIRCLE **423** ON READER SERVICE CARD

An outstanding program, from a company with the improbable name of the Perfection Form Company, is *Masterword*, a vocabulary series in three packages.

Just the appearance of *Masterword* is enough to inspire confidence; the cloth covered, small format looseleaf binders are a subdued beige with blue lettering. Inside, we find professionally typeset manuals on heavy stock with lots of screen illustrations.

The product virtually radiates competence—so much so that I was almost afraid to boot the program, fearing yet another occasion to warn readers against judging books by their covers. But no, this series proved to be as competent as it looked.

The three *Masterword* packages are subtitled Wordshark 1, 2, and 3. Although the words in each package are assigned difficulty levels from 1 to 4, there seems to be very little variation in difficulty among the packages. Suffice it to say that if you like Wordshark 1, you will probably want to augment it with the additional words in Wordshark 2 and 3.

Each disk presents 11 lessons of seven words each. Each lesson offers four activities using those seven words. The first activity on the menu is Showcase, a simple matter of choosing the correct definition from a list of three. If you choose incorrectly, you get a hint and a second try. Wrong again? You get a second hint and a third try. At the end of the exercise, the program tells you how many words you defined correctly on the first, second, and third try.

The second activity, Synonyms and Antonyms, is one of the best vocabulary exercises I have seen in a computer program. At the top of the screen you see a list of words among which are a synonym and an antonym for each word in your study list. The bottom half of the screen displays the words in the lesson and space in which to type the synonym and antonym of each. Each word can be used only once, but if you type one in and later discover that it goes better with another word, you can correct it before the score is calculated. This is an excellent format, because it pushes you to learn more than just the definition.

Analogies is the third activity in each lesson. Here you see 10 words at the top of the screen. You must choose from the list the words that best complete the analogy sentences that appear below: PLEAD is to BEG as ABUNDANT is to ________. Although the analogies are very simple (synonyms and antonyms only), this, too, is a valuable exercise.

Acrostics, the last activity in the lesson, is intended to "develop a familiarity with the master words through reinforcement of letter sequencing." Well, maybe. Inserting the words into the acrostic pattern blanks is moderately challenging, but, in my opinion, of limited educational value.

The Gradebook disk allows the teacher or parent to check on the progress of the students using the program. You can check the performance of the entire class on a given lesson, a single student on a given lesson, or a single student on all lessons.

The documentation, as mentioned

SMARTER

USRobotics' new high-speed Courier 2400™ modem responds to the industry standard AT command set—so it works with any of today's popular telecom software, including our own Telpac™. Courier reports the length of each call, lets you automatically repeat a command, and provides an on-screen summary of its settings. Courier even adjusts to phone line conditions to assure nearly perfect performance on every call. This smarter modem is clearly a wise choice.

courier 2400
USRobotics™

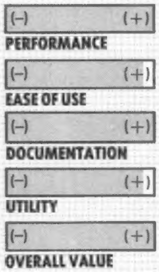
8100 McCormick Blvd., Skokie, IL 60076
Phone: (312) 733-0497
Outside Illinois: 1-800-Dial-USR

CIRCLE 119 ON READER SERVICE CARD

above, is very well done. In addition to being attractively and accurately presented, the information is complete almost to a fault; on page 4 you are advised to "carefully remove the appropriate *Masterword* diskette from its protective envelope." At the end of the general instruction section, the manual includes a list of the words on the disk, along with definitions, synonyms, antonyms, and completed acrostics.

Masterword scores well on all the criteria we apply to educational software: the educational material is worthwhile, the documentation is complete and attractive, and the program itself is well executed. At $59.95 for an individual package and $159.95 for all three, the price is quite reasonable for a school and not beyond the reach of most computer-using families. *—EBS*

Paper Clip



System and Price: Atari, $59.95; Commodore 64 disk, $89.95

Summary: The premier word processing software for low-end machines

Manufacturer:
Batteries Included
30 Mural St.,
Richmond Hill
Ontario, L4B 1B5
Canada
(416) 881-9941

CIRCLE **424** ON READER SERVICE CARD

The premier word processing package for the Atari has been improved. *Paper Clip* is easy to use, yet offers the advanced features of programs designed for the IBM PC and Apple. These include: block move, copy, delete, macros, dual text windows, automatic page numbering, headers, footers, table of contents, underlining, boldface, super- and subscripts, variable character pitch, and custom character sets.

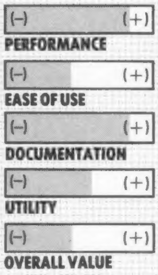
The editing screen can be set up to 130 columns wide, and text can be scrolled in any direction, by the letter, word, or entire screen. A preview mode displays formatted text exactly as it will appear on the printed page. You may further define your own formatting parameters, including screen color, intensity, margins, line lengths, page length, and spacing, then store these choices as a customized version of the program.

Paper Clip contains over 30 printer files for all the current models you may own alongside your Atari. It also features a built-in program that lets you create additional files for new printers that may appear in the future. The package is file compatible with standard DOS files and most earlier Atari word processors. Formatted text can be saved to disk, which is a convenient feature for telecommunications uploading.

A built-in custom DOS automatically detects and utilizes the appropriate disk density. On-screen help is available from any point in the program, and the program automatically saves files to disk as you write. The documentation is excellent and the disk itself unprotected, though keyed through a joystick port. This means you can make as many backup copies as you like, but can use the program only when the key is inserted.

Paper Clip is compatible with the 48K models 400 and 800, as well as all model XLs and XEs. Mail merge capability is possible in conjunction with *Synfile*, a file manager program also from Batteries Included. You will not find an Atari word processing package superior to this one*—JJA*

MindReader



System and Price: 256K IBM PC; $189

Summary: Distracting word processor

Manufacturer:
Businessoft
703 Giddings Ave.
Annapolis, MD 21401
(301) 263-1962

CIRCLE **425** ON READER SERVICE CARD

The title conjures up visions of tarot decks, rune sticks, astrology charts, and other prognostic devices. However, nothing could be farther from the truth. *MindReader* is a word processor with built-in keyboard macros. It is designed for executives and professionals who need to write short one- to three-page letters.

Its big gimmick is an interactive keyboard macro that anticipates what you are going to type. The program compares the characters you are typing with words or phrases stored in a dictionary. When enough characters match, a pop-up window appears in the text with a short list of choices. You pick one and the rest of the characters fill in on the screen automatically.

For example, typing "inv" triggers a pop-up menu with the choices investment, invest, investigation, inventory, invitation, invite, invoice, and involve. If you want the word "investment," you press the 1 key and the program automatically finishes the word.

Likewise, you can call up a glossary and insert whole sentences, paragraphs, or other boilerplate material. A Rolodex feature is also integrated into the program and allows you to insert names and addresses with a couple keystrokes and set up mail merge documents.

In theory, the idea of filling in the rest of a word with a single keystroke sounds great. However, in practice, those pop-up boxes wink in and out so much that it makes the program look like an explosion-filled arcade game. To say that they are distracting is an understatement.

You can disable this feature, but then you are left with a no-frills word processor with only a few special editing and formatting functions such as centering, underlining, and boldfacing. It does make good use of the function keys and has terrific sound effects. *MindReader* also contains a rudimentary daily scheduler, calculator, word jumble game, and practice function.

With a suggested retail price of $189, *MindReader* will appeal only to those whose minds need a lot more than reading. The concept is admirable, but those pop-up windows create a distracting screen. You are better off learning to use a more sophisticated word processing program and adding a keyboard macro program, or, purchasing one of the many inexpensive no-frills word processors already out on the market. *—RSL*

Slide Show Magician

(–) (+)
PERFORMANCE

(–) (+)
EASE OF USE

(–) (+)
DOCUMENTATION

(–) (+)
UTILITY

(–) (+)
OVERALL VALUE

System and Price: Macintosh; $59.95

Summary: A natural extension to *MacPaint* for creating screen presentations

Manufacturer:
Magnum Software
21115 Devonshire St.,
Suite 337
Chatsworth, CA 91311
(818) 700-0510

CIRCLE **426** ON READER SERVICE CARD

This program is a must if you ever use the Macintosh for its graphics. If you don't use the Macintosh for its graphics, you would, if you had this package. *Slide Show Magician* allows you to create cohesive presentations using *MacPaint* documents and to chain them together with sophistication and dramatic effect. Whether you are interested in business graphic presentations or a gallery of fine art, this package turns your Macintosh screen into a powerful communications medium.

Fades, wipes, pointers, added text, all are possible—along with a choice of buttons for user input. Once you have constructed a show, you can save it to its own disk along with an unprotected Projector file. Your show will then autorun without rebooting the protected master disk.

The Macintosh screen displays only the upper left corner of a Macintosh document, and a file called Graph Format can help you design your documents to fit. We cut out a cardboard frame to hold over the Show Page mode in *MacPaint*, and found that to be a help as well. We also suggest that you strip all accessories off the system folder to save disk space.

The program has some rough edges. It does not make remarkable use of the desktop metaphor, and some things are more difficult to do than might have been necessary. We also found that the program was incompatible with hard disks—both Tecmar and Hyperdrive. A pity.

But the results possible with *Slide Show Magician* far outweigh its faults. Remember how obsessed you were with *MacPaint* when you first got it? Well *Slide Show Magician* is the next logical step.—*JJA*

Mach 5 Enhancement

(–) (+)
PERFORMANCE

(–) (+)
EASE OF USE

(–) (+)
DOCUMENTATION

(–) (+)
UTILITY

(–) (+)
OVERALL VALUE

System and Price: Commodore 64 disk; $29.95

Summary: Fast loader with utilities is a good value

Manufacturer:
Access Software
900 South 925 East
Salt Lake City, UT
84105
(800) 824-2549

CIRCLE **415** ON READER SERVICE CARD

This combination ROM cartridge and disk consists of three components: a fast loader cartridge, a disk module that adds 4K to the Basic workspace, and a disk organizer program.

The fast load component is the most significant of the package, allowing programs to load from the 1541 drive up to five times faster than they do without the Mach 5 enhancement. The cart is completely transparent and does not disturb the contents of RAM. It works automatically and loads all popular software, protected or not. It includes 15 macros that allow single keystroke program loading, print commands, screen dumps, and non-volatile disk directories.

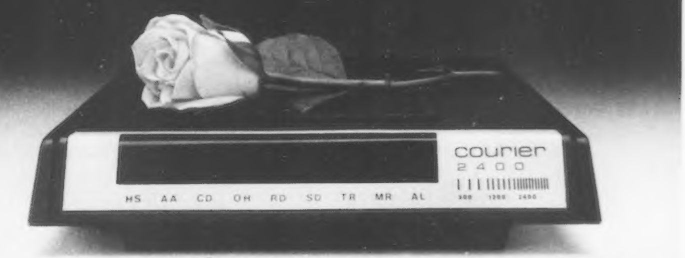
The Basic module makes an additional 4096 bytes available for Basic programming. It runs as a program itself, automatically installing the extra addresses to memory. The Mach 5 module is automatically disengaged when the Basic module is run.

The disk organizer module is a disk management program that allows you to catalog your disks and save the information to a master data disk. It works optimally on a dual disk system, but will run in a single disk configuration. Each time you add a new disk to your library, you can add its directory to the catalog data and sort those catalogs as you see fit.

While the disk components of the Mach 5 enhancement packages will be of utility to some users, it is the Mach 5 quick load ROM itself that makes the package extremely worthwhile.—*JJA*

FRIENDLIER

USRobotics' new super-speed Courier 2400™ modem is designed to make things simple for you. The entire AT command set and S-register functions are displayed on "help screens" and summarized for you on the underside of the unit. Courier shows you the length of each call, and the status of a call in progress. And perhaps the friendliest thing of all is the $699 price tag. How friendly can you get!



courier 2400
USRobotics™
8100 McCormick Blvd., Skokie, IL 60076
Phone: (312) 733-0497
Outside Illinois: 1-800-Dial-USR

CIRCLE 120 ON READER SERVICE CARD

Computers in Hollywood

Ken Uston

Computers—mainframes, minis, and micros—have touched and changed the nature of show business as they have changed just about every other kind of business being conducted in the U.S. today.

To make movies, TV shows, and commercials, Hollywood is using everything from the low end Commodore 64 (for scoring music) to the ultra high end $12 million Cray X-MP (for graphics and animation). The machines are involved in all three phases of the film-making process:

- Pre-production, which consists of such tasks as getting the script in shape; hiring the director, film crew, stars, actors, and extras; getting the props built; and selecting locations for the filming.
- Production, which consists of the "shoot" or actual filming—on a studio lot, in a rented studio, or on location.
- Post-production, which includes such apres-shoot activities as editing, sound dubbing, and superimposition of music.

Growing Computer Literacy

In addition to the appearance of computers in studios, there are other indications that Hollywood has joined the computer revolution. Just last year, for example, The Micro Show, a microcomputer conference for the entertainment industry, premiered. More than 50 computer companies exhibited hardware, software, and other high tech products. Specialists discussed the use of personal computers in all three phases of the film-making process.

The show was so well attended that this year it will be expanded to include more topics of interest to show business people. It has been renamed ShowBiz Expo '85 and shows signs of becoming an annual event.

Not to be outdone, the National Association of Broadcasters this year included myriad exhibitors of electronic and high tech products for the film and TV industry (video monitors, editing systems, electronic cameras, etc.) at its 62nd annual convention. The show reminded me of our industry's Consumer Electronics Show; in fact, many names familiar to CES goers were prominent at the NAB convention—Sony, Thorn/EMI, Toshiba, and Yamaha, to name a few.

Computers now enable editors to edit videotape electronically. I (center) had the opportunity to observe the process firsthand recently after making a videotape on how to play blackjack for Hollywood producer Dale Crase. The tape shot by each of three cameras was displayed simultaneously on three monitors. Periodically, director Joel Colman (right) would shout "Cut to 2 . . . Now!" Each time, a computer operator, sitting at a keyboard with a monitor on which the frame numbers were displayed, pressed a few keys. The machine whirred briefly, and, magically, the results appeared on the center screen. Although it took 10 hours to edit the 75-minute tape, Colman assured me that doing it manually would have taken far longer and we would have had to wait to see the results.

To help people keep up with advances in the computer field, Lawrence Saltzman, a writer, teacher, and computer consultant, organized the Association of Entertainment Industry Computer Professionals. "I formed the group because things were disorganized. People in the entertainment industry needed to talk to each other about computers—to find out what was going on. End users were in the dark; people were buying computers without having the foggiest idea what to do with them," says Saltzman, who is also president of Entertainment Computer Systems, a computer consulting firm which caters to the needs of the entertainment industry.

In a more specific move, the Directors' Guild of America (DGA) has instituted a program to teach Hollywood directors how to use computers for such specific tasks as word processing and making spreadsheets. Also available through DGA are industry-specific sessions that teach the use of computers for production scheduling, budgeting, and accounting.

Show Biz Mainframes

The large movie and TV companies, like Universal, MGM/UA, and Disney, use mainframes just as any large business would for day-to-day data processing and corporate accounting, but the big machines are used in a variety of show biz applications as well.

Robert Oleesky, manager of corporate data processing for MCA, Inc. (which owns Universal Studios), says "Since the late 70's, we have branched out into entertainment applications. One of the first was putting the names of hundreds of extras into computer files. We record physical characteristics and other attributes—7' tall, owns motorcycle—for casting purposes.

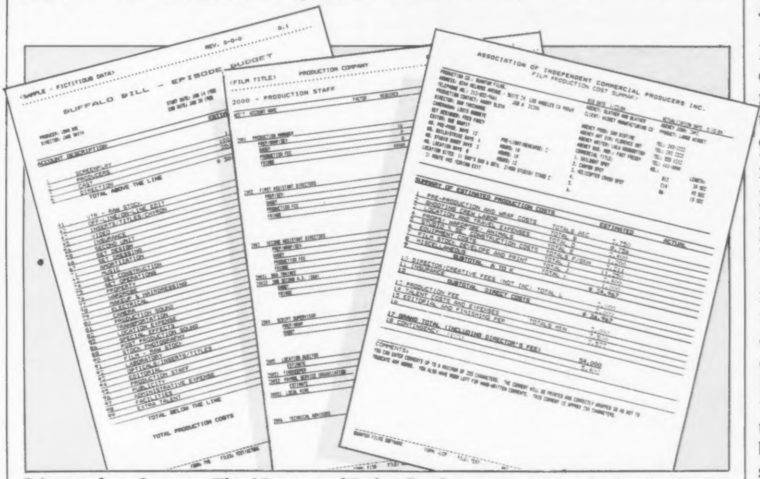
"Then we built a film transportation program. If a producer says, 'I need a jeep,' the program can list for him all jeeps, their drivers, union seniority of the drivers, availability, and so on.

"We also do studio call sheets on the mainframe. For each TV and feature film, we list all the stars, stuntmen, extras, caterers, and others who are to work on it. The program produces a printout that we can distribute each day to tell everyone where he must be the following day.

Universal's mainframe is an IBM 3081. Across town in Beautiful Downtown Burbank, Disney Productions uses a 9080 series Sperry with series 1100 Univacs. The Disney mainframe keeps track of TV and movie distribution (appropriate markets, location of prints, etc.), rights (home video, pay TV, foreign exhibitors, etc.), and production costs.

Disney management, recognizing the increasing importance of computers of all sizes, recently appointed Bob Gordon to the position of MIS Liaison. His job is to determine whether and how each problem is best solved, using a mainframe, a mini, or a micro.

At Disney, as elsewhere in Hollywood, personal computers are very much in evidence—scattered around studio lots, carried on location, and relied upon in countless small production houses, by producers, directors, and screenwriters.



Printouts from Quantum Films' Datamogul Budget list the expense categories involved in film production. The program can handle a 22,000-line budget on a single floppy disk.

Applications

The first word processing program for a personal computer, *Electric Pencil*, was written in 1978 by a screenwriter, Michael Shrayer. Since then, screenwriters have embraced the concept wholeheartedly, appreciating especially the ability of the programs to handle the complex formatting requirements of movie and TV scripts. "By and large," says Universal's Oleesky, "the entire Hollywood script writing community has settled on *WordStar* and Microsoft *Word*." The Writers' Guild recommends both programs.

The list of off-the-shelf software that has become popular in Hollywood holds no surprises. *Lotus 1-2-3* is widely used to control production budgets, and *dBase II* and *Microplan* help organize data and formulate projections.

The Bottom Line of Pelham, NY, markets a series of *Lotus 1-2-3* templates designed specifically for the entertainment industry. They can be used to keep track of production costs, assign and sort camera shots, and create efficient shooting schedules by shuffling actors, scenes, and locations. A payroll template compares actual to budgeted figures for shooting crew salaries.

Prolific songwriter and TV personality Steve Allen keeps a Kaypro 2 busy at his Hollywood offices. He uses *Perfect Filer*, a CP/M database management program, to maintain the records for the more than 4000 songs he has composed.

Another Kaypro is at work in the Colman Group, a Hollywood production company. It is used to maintain a mailing list of 5100 advertising agencies, a catalog of the company's VCR movie library, a restaurant guide, and, most important, an inventory of owner/director Joel Colman's electric train collection.

Both Universal and Disney use IBM PCs on location to upload financial data via modem to the headquarters mainframe to keep track of daily production costs. For example, two PCs accompany Tom Selleck on location in Hawaii for the filming of "Magnum P.I." There they record incidental expenses and handle accounts payable and payroll. Universal's "Miami Vice" also uses a PC on location.

Oleesky notes that perhaps the most important role of PCs on location involves daily script revisions. "The changes are sent instantaneously to the executive producer in here at Universal. In the old days, we had to send script revisions in pouches on airplanes. An artistic argument could cost us $50,000 a day, because people are paid whether you shoot or not."

Vertical Software

While off-the-shelf software serves well in general applications, many computer users in the entertainment industry are finding that their problems can be solved only by software created specifically for their needs. Dotzero, Inc. and Quantum Films are two companies that were started almost by accident when their founders saw such a need and filled it.

A few years ago, Jack C. Smith was a movie production manager. Wanting to automate, he went shopping for software and found nothing that could help him, so he started Dotzero, which today serves many clients, including MGM/UA and 20th Century Fox in Hollywood and Pinewood Studios in England. Smith attributes his success in the vertical software market to the experience of the company in both entertainment and computing. Dotzero's best-selling programs are:

- *Scheduling*, a program that keeps track of all the scenes in a movie and how they finally fit together. "Scenes are not shot in the order you see them on the screen," explains Smith. "They are all jumbled up during shooting."
- *Accounting*, a program designed to keep production costs within budget (which may mean $1 million per week).

The Dotzero accounting program records costs and provides the producer with up-to-date financial information.

- *Budgeting*, a program to help the producer create a budget—a difficult task because of the thousands of expense items often associated with a single movie.

Emil Safter, founder of Quantum Films, was a nuclear physicist before he became involved in the entertainment industry. He says "I fell into entertainment software backwards. When I was involved in movie production, I thought I had put my science hat away, but when I began making budgets and schedules, it became clear that a computer could do the job much better—that was back in the early days of the Apple.

"I computerized the breakdown of the script and scheduling and soon found that friends to whom I had given the programs were excited about them. Eventually, I had so many requests that I had to start charging."

Quantum's first product, called *Datamogul Budget*, has been on the market for about a year. Safter says, "The average feature film budget can easily be 100 pages long—we're talking about accounting for $10 million and 15 different unions, each of which has different rules and pay codes." *Datamogul Budget* can handle a 22,000-line budget on a single IBM or Apple II disk.

Datamogul Script Breakdown allows the assistant director to analyze the script and prepare a production schedule and cast list—a list of what days which actors are working. This list, called "day-out-of-days," is very important in cost control. Safter explains: "If an actor works on Monday and on Friday, he must be paid for the intervening days. Poor scheduling, which causes actors to be paid for many days that they don't work, can be very costly."

Another program, *Datamogul Report*, is about to be released. It generates the many reports required by the Screen Actors' Guild and the studio.

Computer Graphics

Computers are revolutionizing other areas of film production as well. As the Lucasfilms "Star Wars" trilogy attests, enormous advances have been and are being made in the use of computer-generated effects and animation for the Big Screen.

One company, Digital Productions Inc., uses a Cray X-MP supercomputer to create state-of-the-art digital animation. Included in its portfolio are 300 scenes for the film "The Last Starfighter" and the planet system for "2010," all of which were created without building a single model or miniature. Everything was done with digital animation.

> **In the old days, we had to send script revisions in pouches on airplanes. An artistic argument could cost us $50,000 a day.**

Cranston/Csuri Productions uses large DEC computers (VAX 11/780 and 11/750) to generate convincing simulated three-dimensional effects on film; their clients include CBS, ABC, NBC, and HBO.

The Future of Computers in Hollywood

There are still many areas in which computer applications can be developed for the entertainment industry. The editing of most film (as opposed to videotape) is largely a manual process; nearly all feature films are still edited mechanically. New laser videodisc editing techniques, which will revolutionize the editing process are currently under development by Lucasfilms and others.

Another area in which computer technology has not yet been exploited fully is the preparation of storyboards, the graphic outline of a commercial, TV show, or movie. According to Universal's Oleesky, "We're looking for a good storyboard program. Very few producers can draw well; we need a program with cartoon figures, trees, cars, furniture, etc. stored on disk. And because very few producers are experienced computer users, the program must be easy to use, requiring very little hand-eye coordination."

Composers also have a great deal to look forward to. Consultant Saltzman suggests that "computers could keep precise counts to help the composer work out tempos and discover where music has to hit to tie in with the film. This is a natural use for computers, because it is simply number crunching.

"And while we are dreaming . . . computers could help in set design, which is a combination of architecture and interior design, by preparing designs, drawings, and blueprints.

"Another area in which we could use help is props. The major studios have huge inventories of props. A database program would be of enormous help in keeping track of props and matching the inventory with the items needed for a given production."

The first major public access electronic database for the entertainment industry was established by Baseline, a New York City company. Its files include credit lists that detail all the parts played by any given actor or actress. According to Salzman, "There's lots more to be done here—keeping track of key technicians, union rates in different cities, and all kinds of things."

But let's take a look at the big picture. What would an overall dream system for a Hollywood producer include? According to Bob Lasiewicz, who operates ShowBiz Expo '85, "People are looking for a more integrated system to handle a variety of production problems in a multi-user environment." Such a system would allow script writers, schedulers, and others to share a single system—a system that would allow more than one person to input data, so one could enter budget information while others dealt with, say, payroll or accounts receivable data. Says Lasiewicz, "Companies run into bottlenecks when they rely on just one machine."

The real problem in the industry seems to be the difficulty novices have just using computers. "It's one thing for a guy to buy his own computer and learn how to use it; it's much more complicated when you have one computer operated by many semi-skilled users. In a business, you have turnover and severe training problems. And a real common complaint around here is that 'computers are hard to use.' "

As computer manufacturers learn that their products are being used more and more frequently by non-technically-oriented people, we hope that this complaint will disappear. When that happens, Hollywood, like the rest of our society will be ready to put even more of its faith in computer technology.

Confides another film expert who asked to remain anonymous, "I'll tell you one thing that will never be computerized, though—let's call it 'Hollywood's creative financial secrets.' " ■

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The World's Worst Computers

David H. Ahl

It started innocently enough. I was reading in a year end issue of some magazine one of those articles about the best and worst of 1984. We had just put together a "12 Best" article (December 1984) so I made a note to myself that sometime we should do a piece about the worst computers around. The note surfaced again in May, and I sent a memo to each editor asking for a list of the seven worst computers and 10 to 30 words on why each was selected.

John called, "Do you mean microcomputers still on the market?" Said I, "Anything goes." Despite the open nature of the requirements, 44 of the 51 nominations were for current or past microcomputers. No mainframes, no minis. There was one vote for a slide rule, one for cardboard computers, four (from one editor) for various computers on TV and in the movies, and one (from me) for Stonehenge.

About the 44 microcomputers, you might think, "Here are seven like-minded editors all working on the same magazine. Allowing for a few differences of opinion, there will be only 10 or 12 computers on the final list." Ha! On the list were 30 computers representing 24 manufacturers. Manufacturers receiving more than one vote included IBM (7), Commodore (4), Coleco (3), Mattel (3), Tandy (3), Sinclair (3), TI (2), Magic (2), and STM (2).

Enough, enough. Here is our list—edited and abbreviated. But don't use it to select your next computer. Quite a few computers on it ranked number one or two in our 12 Best list last December. It just goes to show that one editor's meat is another editor's poison.

IBM PC

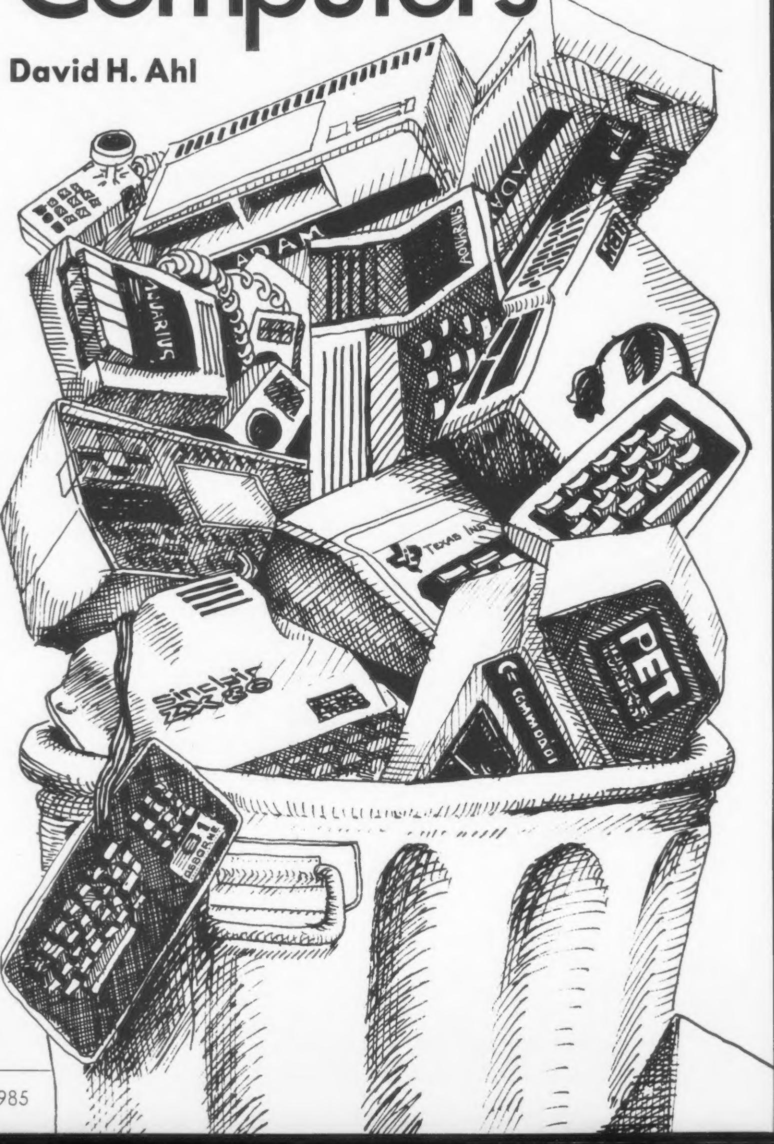
A computer designed solely to dart and tag the micro market for eventual, inevitable domination by the Big Blue Behemoth.—*JJA*

This machine virtually defines the phrase "user-hostile" with its non-resident DOS, piecemeal expandability, and unintelligible documentation.
—*EBS*

Moreover the first models misplaced a decimal point in certain calculations.
—*RSL*

IBM PC Clones

Opportunistic manufacturers have perpetuated—indeed, institutionalized—an uninspired design by fearing to deviate from the "standard" set by Big Bully.—*EBS*



IBM PCjr

As Leonard Pinth-Garnell (Dan Ackroyd) used to say on "Bad Theater" (Saturday Night Live), the IBM PCjr is "truly bad, almost unbearably putrid." —*JJA*

An embarrassing faux pas that temporarily humbled Big Blue with its inexcusable wireless Chiclet keyboard.—*OWL*

It's heartening to see that even IBM can't get away with Chiclet keyboards, single disk drives, and memory limitations.—*JD*

Apple Macintosh

Screen too small, disks too slow, architecture shut tight like a littleneck clam. (Macintosh is also number 1 on my "Seven Best Computers" list.)—*JJA*

Commodore Plus 4

A machine much less powerful than the Commodore 64 that sold for twice the price. Built-in software was an embarrassment, every I/O slot redesigned to ensure incompatibility. —*JJA*

The built-in integrated software catapulted you into the dark ages of computing.—*JD*

Commodore 64 (with disk drive)

Waiting for Godot.—*OWL*

Original Commodore Pet

Its small gridlike keyboard and hardware-killing POKE combined to make this the perfect boat anchor. —*OWL*

Coleco Adam

Tape drive unreliable, printer worked only sporadically, software full of bugs and without documentation. —*CAC*

Too much new technology, too much hype, and not enough quality control resulted in a machine that rather than being all things to all people, turned many people against computers—perhaps forever.—*EBS*

I wouldn't give one to a Cabbage Patch Doll.—*OWL*

Mattel Intellivision/Aquarius

Intellivision was the earliest vaporware introduction in the industry. Finally the Aquarius showed up. A machine so cheesy, they should have supplied rubber gloves to wear while using it.—*JJA*

Another attempt to apply mass merchandising techniques to home computers—poor design, low quality, no support.—*EBS*

Worse keyboard than even the original CoCo, 99/4, or PCjr.—*CAC*

Rabbit

Like the Aquarius I, this shoddy import from Hong Kong came without a spacebar.—*RSL*

Sinclair ZX80

With an unusable keyboard and quirky keyword Basic, this machine discouraged millions of people from ever buying another computer.—*DHA*

Looks like a toy, keyboard designed for elfin fingers, much too slow.—*CAC*

Timex/Sinclair 2068

The keyboard can't be used for serious typing. Also, much of the excellent Spectrum software can't be used because Timex changed the original Sinclair ROM.—*PEG*

All Cassette-Based Computers

I'd rather enter Orwell's Room 101 and let rats gnaw on my face than attempt to load a program from cassette. —*OWL*

Tandy MC-10

A scaled down Color Computer. That's like saying a poor man's Volkswagon Beetle.—*OWL*

The what?—*EBS*

TI 99/4

With its Chiclet keyboard, not enough keys, and non-standard Basic, this machine soured millions of people on computers forever.—*DHA*

Not to mention its highly impractical 4' x 1' footprint (with peripherals).—*EBS*

Video Brain

Running APLS (a scaled down version of APL), the Video Brain required a degree in computer science to program it. It did have nice joysticks though. —*DHA*

APF PeCos I

With no support at all, APF released a machine that used a JOSS-type of language that was totally incomprehensible.—*DHA*

Epson QX-10

Nice hardware, but the Valdocs software is extremely slow, cumbersome, and frustrating.—*PEG*

Osborne I

An idea whose time had not yet come. Osborne applied to computers the principle that TV manufacturers have been using for years: if it has a handle, it's "portable." Not many people believed this, and those who did ended up with severe eyestrain.—*EBS*

STM PC

Illegible full-screen LCD, but could not be powered by batteries. Printer: thermal; width, four inches; speed, 10 cps; legibility, low. Only review I ever wrote that said, "don't buy this."—*JJA*

The least compatible PC compatible ever.—*CAC*

Hyperion

The clone that wasn't. All snazz and little compatibility.—*CAC*

Data General/One

A portable computer whose screen you couldn't read and whose integral communications program wouldn't allow you to download to disk.—*JD*

Morrow Pivot I

Though heralded as the ultimate IBM PC compatible portable, I couldn't even read its almost upright screen, nor was it particularly compatible.—*JD*

Sord IS-11 (Lapsize)

The operating system was so difficult to learn that by the time you got it down, the batteries ran out.—*JD*

Gavilan

The term vaporware is usually applied to software; Gavilan proved it could be applied to hardware as well. —*DHA*

Magic Computer

Manufactured in Taiwan, this was the shoddiest "modern" CP/M computer I ever tested.—*DHA*

One of three machines tied for having the worst names; the others are Pied Piper and Amcute.—*CAC*

Computer Devices DOT

Its 3.5" disk drives required that all software be converted before use. Printer used roll paper, unpopular ever since scrolls went out of style.—*CAC*

Stonehenge

The hardware was solid—still is—but trying to debug the operating software wiped out the Druids.—*DHA* ■

Don't the Debits Go Toward the Window?

An introduction to double entry bookkeeping/**Douglas A. Kerr**

No, "double entry bookkeeping" doesn't mean having one set of financial records for the IRS and another for yourself. It refers to the ingenious concept that is the basis of the bookkeeping systems used by almost all major businesses today.

When we look at the manuals for double entry accounting software packages, we often find unfamiliar terminology and concepts. Let's penetrate this veil of mystery and see what double entry really is all about.

The principle of double entry bookkeeping is simple. Every financial transaction—that is, any movement of money or another item of value—is recorded by making a change in one account and an equal but opposite change in another account. The symmetry of this method allows us to perform various checks throughout the process to prevent arithmetic and procedural errors. This is one of the most important features of the double entry system.

The accounts maintained are of five types. The first type is the *asset* account. These accounts indicate the items of value the business currently holds. An item of value may be cash (meaning, generally, bank accounts), or the value of buildings, furniture, material, or other property. Another item of value is the right to collect amounts owed by others, such as customers. These amounts are called *accounts receivable*.

The second type of account is the "liability" account. These show how much the business owes to others—in effect, how much of the total assets does not really belong to the business. A common kind of liability account is called *accounts payable*. It shows how much the business owes to others, such as suppliers.

The net amount currently invested in the business by the owners (their *equity*) is reflected by the third type of account, called *capital*. From a procedural standpoint, capital accounts are treated much like liability accounts. It is as though the business owed these amounts to the owners.

These first three types of account represent the current status of the items of value held by the business. In contrast, the last two types show the flow of money into and out of the business. They are called *revenue* (or income) accounts and *expense* accounts. Those names are self-explanatory.

Balancing is like a giant parity check on the entire accounting process.

Debits vs. Credits

At the outset, we described making *equal and opposite* changes to a pair of accounts. What exactly does that mean?

In traditional mathematics, there is the concept of two *directions* of a number, which are called positive and negative. In accounting there is also the concept of two directions of a number; they are called *debit* and *credit*.

The current value of an account is its *balance*. By convention, the direction of the balance of a normal asset account is debit. Since a liability account carries the opposite meaning, its normal balance is in the direction of credit, as is the balance of a capital account.

Revenue and expense accounts are directly related to capital accounts. The net income of a business—that is, the revenue less the expenses—increases the amount of the owners' equity. Accordingly, the direction of the balance in a revenue account is credit, just like that of a capital account, and the direction of the normal balance of an expense account is the opposite—debit.

In many common formats for keeping double entry records, the balances in the different accounts do not carry debit and credit markings to show their direction. Bookkeepers and accountants know the normal directions, and standard bookkeeping procedures keep everything pointed the right way.

Using this terminology, we can restate the fundamental concept of double entry bookkeeping thus: when a transaction is recorded, one account receives a debit (a change in the debit direction) while the other receives a credit of identical size.

As in the case of conventional mathematics with positive and negative numbers, the effect of a change upon the numerical value of the balance depends on the directions of the balance and of the change. For example, a credit applied to an account with a balance in the credit direction (a *credit balance*) increases the balance; a credit applied to an account with a debit balance decreases the balance.

For example, suppose that we pay the power company $150 for the month's service. We would record that transaction as in Figure 1.

The first part increases the balance of the Utilities Expense account, which shows that an additional amount has been spent on utilities. The second part decreases the balance of the Cash on

Figure 1.

Debit Utilities Expense account (an expense account: debit balance)	$150
Credit Cash on Hand account (an asset account: debit balance)	$150

Debit Cash on Hand account (an asset account: debit balance)	$100
Credit Fees Earned account (a revenue account: credit balance)	$100

Figure 2.

Hand account, which shows that the business now has less cash.

If we then received $100 for performing a service for a customer, we would record the transaction as shown in Figure 2.

The debit to Cash on Hand increases the balance, showing the increase in our cash. The credit to Fees Earned also increases that balance, showing that additional fees have been earned.

When a business is founded, the initial balance of every account is zero. We can say that the sum of all the debits (none at this time) equals the sum of all the credits (also none at this time).

Each time we *post* a transaction, we apply a debit to some account and a credit to another. If we post several transactions at one session, the sum of all the transaction debits will equal the sum of all the transaction credits. After the transactions have been posted, the sum of all the debit balances will still equal the sum of all the credit balances.

On Balance

The process of checking for this equality of debits and credits on all transactions and on all account balances following the effect of the transactions is called *balancing*. It is like a giant parity check on the entire accounting process.

We said that there was a normal direction for the balance of each type of account. Sometimes, the value of an account can have the opposite direction. Take for example the accounts receivable account for one customer. It shows what the customer owes us. This account is an asset account, because the right to collect what the customer owes us is an item of value. Accordingly, such an account normally has a debit balance. Purchases by the customer result in debits to the account, and payments result in credits.

Assume, however, that the customer for some reason makes a payment larger than the amount he owes us. This results in a credit balance in his account (signifying that we owe him). Since debit is the normal direction of the balance of such an account, the credit balance is abnormal and is shown on the records with a CR (credit) symbol, by putting parentheses around the number, by printing the number in red, or by preceding it with a minus sign.

	Debit	Credit
Printing Expense	$50	
Office Supplies Expense	$25	
Cash on Hand		$75

Figure 3.

We said before that in recording a transaction a debit is made to one account and a credit to another. In fact, sometimes there can be more than two accounts involved. Suppose we have paid $75 to the stationer, $50 for printing business cards and $25 for office supplies. We might record that transaction as shown in Figure 3. This is called a *compound entry*. It still follows all the rules—the sum of the debits equals the sum of the credits.

Incidentally, the example in Figure 3 shows an accounting convention: the debits are shown in the lefthand column, and the credits to the right. This allows the debits and credits to be summed in a batch of transactions to see if they balance. It is customary to list the debit elements first.

A list of transactions in this format is called a journal. Transactions are recorded in a journal as they take place. The bookkeeper then can post their components to the various accounts at some convenient time, marking on the journal when each transaction has been disposed of.

General Ledger

We often see the term *general ledger* in connection with accounting systems. The general ledger of a business is its basic set of accounts, reflecting overall financial operations. Although these accounts reflect all financial activity, they do not always reveal the details. For example, there is not normally a separate receivable account for each customer in the general ledger. Rather, there is a single accounts receivable account summarizing the total owed by all customers.

This is then supplemented by a set of subsidiary accounts—one for each customer. Customer transactions (purchases, payments on account, etc.) are posted to each customer's individual subsidiary account. The total of these transactions is then posted to the overall accounts receivable account and the other affected accounts in the general ledger.

Each account in the general ledger is usually identified with an account number. It is customary to arrange the accounts and their numbers in groups, such as all asset accounts in the 100 series, all liability accounts in the 200 series, and so forth. A list of all the accounts in a company's general ledger is called the *chart of accounts*.

At the end of an *accounting period* (usually a month), the bookkeeper engages in a process known as *closing the books*, which includes verifying that all transactions have been posted and that the accounts are in balance. Various accounting reports are then prepared to show the financial state of the business.

One important report is the *Income Statement*. This lists the balances in all the revenue accounts followed by the balances in the expense accounts. Finally, it states the difference, which represents the net income (or loss) for the business during the period.

After the Income Statement is prepared, the balances of all revenue and expense accounts are transferred to a special capital account. This reflects the effect of the net income (or loss) of the business on the owners' equity. The transfer process also brings the individual revenue and expense account balances to zero. In this way, those accounts start fresh for each period.

However, a separate set of running totals of all revenue and expense accounts is kept throughout the year. This allows the accumulated *year to date* figures for the different accounts to be seen at any time. These are usually printed on the income statement along with the balances for the current period.

Next, a report known as a *Balance Sheet* is prepared. This lists all asset, liability, and capital account balances. Since all other accounts (revenue and expense) have zero balances at this time, the accounts shown on the balance sheet will be in balance by themselves.

These, then, are the fundamentals of the double entry bookkeeping system. I hope this introduction has helped to clarify the language used in accounting software manuals or by your accountant.

Of course, we have just touched the surface of the subject, and I have taken a few liberties with rigorous accounting terminology in the interest of clarity. The reader who would like to learn more, or who plans to become involved in the use of double entry bookkeeping, may wish to consult one of the many books which are available on the subject. ■

WHAT'S NEW

The latest in hardware and software/**Russ Lockwood**

Protection Devices for Your Computer

Computer Power Solutions has introduced the Electra Guard RS-232 surge protector/lightning arrester. It attaches to the RS-232 port and grounds overvoltages, transients, and surges caused by electrical interference and lightning. It retails for $49.95.

Computer Power Solutions has also introduced an RS-232 gender changer for $19.95 and an RS-232 data line tester for $29.95.

Computer Power Solutions
8800 49th St. N.
Pinellas Park, FL 33565
(800) 237-6010
(813) 544-8801

CIRCLE **427** ON READER SERVICE CARD

Tripp Lite has released the Isobar Command Console, a power control console with full spike/surge and RFI/noise protection. Your monitor rests on the control console which in turn rests on your computer. It has a disk holder compartment and retails for $129.

Tripp Lite
500 N. Orleans St.
Chicago, IL 60610
(312) 329-1777

CIRCLE **428** ON READER SERVICE CARD

American Power Conversion has introduced the 450AT, an uninterruptible power supply for the IBM PC AT, Compaq Deskpro, TI Business Pro, AT&T Unix PC, and other advanced microcomputers. It includes an internal, sealed battery providing 15 minutes of power for a PC AT with hard disk and monitor, surge protection, and EMI/RFI filtering. The 450AT retails for $799.

American Power also manufactures the 300PC, an uninterruptible power supply for the IBM PC, Apple II series, Macintosh, TRS-80, and other computers with moderate power consumption. The 300PC provides up to 45 minutes of power and retails for $599.

American Power Conversion
P.O. Box 723
Peterborough, NH 03458
(800) 343-2507
(603) 924-6115

CIRCLE **429** ON READER SERVICE CARD

CVI Laser has introduced KBD-Lock, a lock and key security device that installs in the back of the IBM PC in five minutes and stops unauthorized use of the computer. KBD-Lock retails for $49.95.

CVI Laser
P.O. Box 11308
Albuquerque, NM 87192
(505) 296-9500

CIRCLE **430** ON READER SERVICE CARD

IQ Technologies has introduced the Smart Data Meter, a handheld data communications analyzer that performs RS-232 diagnostics. It retails for $425.

IQ Technologies
11811 NE First St.
Bellevue, WA 98005
(206) 451-0232

CIRCLE **431** ON READER SERVICE CARD

ACT Apricot

A year ago, we reported on four new computers from ACT, a British microcomputer manufacturer. ACT has reintroduced the Apricot F1 with more RAM and a lower price, and announced the F2 and F10 models.

The F1 is built around a 16-bit Intel 8086 microprocessor and features 512K RAM, one 720K 3.5" floppy disk drive, color graphics, an infrared keyboard, and an infrared mouse. It comes bundled with MS-DOS, Activity icon-based user interface, and a series of Macintosh-like programs: GEM Desktop interface, *GEMWrite* word processor, and *GEM-Paint* graphics program. The suggested retail price of the F1 is $995.

The F2, which is the same as the F1 but with two floppy drives, retails for $1495. The price of the hard disk model, the F10, has not been set.

Apricot
47173 Benicia St.
Fremont, CA 94538
(415) 659-8500

CIRCLE **432** ON READER SERVICE CARD

Low Priced PC Compatible

Leading Edge Products has introduced the Model D PC, an IBM PC compatible manufactured by Daewoo Co. (South Korea) and priced at $1495 for the base model. Built around a 4.77MHz 8088 microprocessor, the Model D features two 5.25", 360K floppy disk drives, 256K RAM expandable to 640K, four expansion slots, Hercules graphics emulation, one RS-232C serial port, one Centronics parallel port, a detachable 83-key keyboard, and a 12" monochrome monitor. A color model and a model with 10Mb internal hard disk drive are also available.

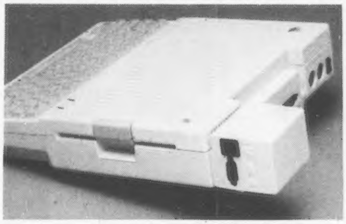
Leading Edge
225 Turnpike St.
Canton, MA 02021
(800) 343-6833
(617) 828-8150

CIRCLE **433** ON READER SERVICE CARD

Modems

Since our "Modem Magic" article appeared in the May 1985 issue, MultiTech and Prometheus have introduced new modems.

Prometheus has unveiled the Promodem 300C, a 300 baud modem that attaches to the modem and game ports of the Apple IIc. It features auto dial/auto redial/auto answer, built-in speaker, ProCom-A software, Hayes compatible command set, and a call waiting bridge. It retails for $199.

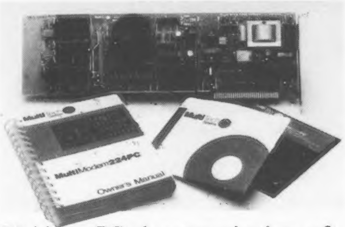


Prometheus has also introduced an electronic mail buffer for its ProModem line of 1200 baud modems. It features two levels of security, clock calendar, and software and can be used as a printer buffer. The base model, with 0K (expandable to 512K), retails for $149.

Prometheus
4545 Cushing Pkwy.
Fremont, CA 94538
(415) 490-2370

CIRCLE **434** ON READER SERVICE CARD

MultiTech has announced the MultiModem 224PC, an internal 2400/1200/300 baud modem for the IBM PC family and compatibles. It automatically switches between speeds, includes MultiCom PC telecommunications software, is Hayes Smartmodem compatible, and includes test diagnostics. MultiModem 224PC carries a suggested retail price of $795.



MultiTech Systems
82 Second Ave. SE
New Brighton, MN 55112
(612) 631-3550

CIRCLE **435** ON READER SERVICE CARD

Integrated Software

Schmidt Enterprises has introduced *Apollo*, an integrated package with database, spreadsheet, and form generation for 128K IBM PC and 48K Apple II series computers. It can transfer data to and from other programs, sort records alphabetically or numerically in ascending or descending order, use numerical accuracies up to 80 digits, and allow up to 10,000 fields per record. The IBM PC version costs $250; the Apple version, $120.

Schmidt Enterprises
15841 Leadwell St.
Van Nuys, CA 91406
(818) 994-4060

CIRCLE **436** ON READER SERVICE CARD

Telecommunications

Business Computer Network has introduced *TelPath*, a full-featured telecommunications program that supports auto dial/auto redial/auto answer, transmission speeds from 110 to 9600 baud, passwords, encryption, macros, clock, phone number directory, and more. It requires a 128K IBM PC or compatible, 64K Kaypro II or other CP/M computer, or Macintosh and sells for $99.95.

BCN also sells add-on programs *TelGate*, which provides single keystroke access to hundreds of databases at no or reduced per hour cost, and *TelMail*, which provides access to various electronic mail services. *TelGate* sells for $39.95, and *TelMail* sells for $69.95.

BCN
1046 Central Pkwy.
San Antonio, TX 78232
(800) 446-6255

CIRCLE **437** ON READER SERVICE CARD

BRS Information Technologies has introduced BRKTHRU, an online menu-driven information service holding 65 databases in fields such as business, health/biosciences, science/technology, social science/humanities, and general reference. Information is in the form of bibliographic citations, abstracts, full-text of articles, or directory/encyclopedia information.

BRS charges a one-time sign-up fee of $75 (includes $25 credit toward service use) and variable per hour rates. The fee includes a user's manual, description of all databases available, and a bimonthly newsletter. BRKTHRU carries no monthly minimum charges.

BRS
1200 Rte. 7
Latham, NY 12110
(518) 783-1161

CIRCLE **438** ON READER SERVICE CARD

Hacker Jack

Baudville has announced the Hacker Jack line of educational software for the Apple II series. *Video Vegas*, a set of four casino games; *Ted Bear Discovers*, three card games; and *Guitar Wizard*, instruction for guitar and other fretted stringed instruments, retail for $29.95 each.

Baudville
1001 Medical Park Dr. SE
Grand Rapids, MI 49506
(616) 957-3036

CIRCLE **439** ON READER SERVICE CARD

Macintosh Speed Reading

Davidson has ported its *Speed Reader II*, a reading proficiency program, to the Macintosh. It retails for $69.95. *Speed Reader II* is still available for the IBM PC, Apple II, and C64.

Davidson & Associates
6069 Groveoak Pl. #12
Rancho Palos Verdes, CA 90274
(213) 373-0971

CIRCLE **440** ON READER SERVICE CARD

MultiMate Just Write

MultiMate has introduced *Just Write*, a scaled down version of its *MultiMate* word processor for the home, office, or school. It includes basic writing and editing functions, boldface, underlining, footnotes, 50,000-word spelling checker, and support for most popular printers. *Just Write* requires a 128K IBM PC or compatible and retails for $245.

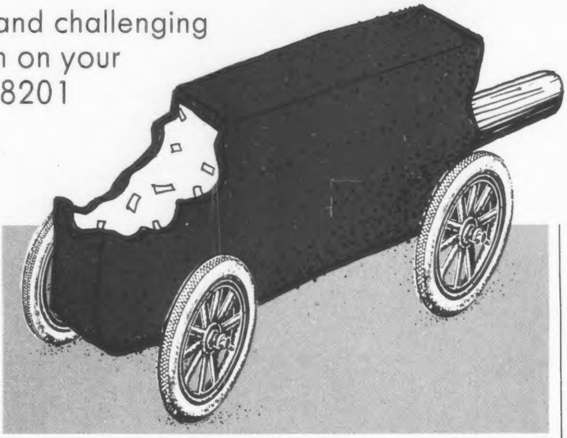
MultiMate
52 Oakland Ave. N.
East Hartford, CT 06108
(203) 522-2116

CIRCLE **441** ON READER SERVICE CARD

Ice Cream Van

Try this entertaining and challenging "business" simulation on your Model 100 or NEC 8201

Steven E. Williams



Are you getting the most from your notebook computer? While TRS-80 Model 100/200, NEC 8201A, and Olivetti M10 owners cherish portable number crunching and word processing, some have yet to explore another application: entertainment. Between "serious" uses, the Model 100 and compatibles can generate loads of fun. Ice Cream Van, for example, is an informal business simulation written in Model 100 Basic. (With minor modifications, it will run on any computer with Microsoft Basic.) The 4991-byte program resides comfortably in lap computers with at least 8K RAM.

In Ice Cream Van you work a part-time refreshment business. Selling nine types of ice cream products from your '79 Ford, you have 21 Saturdays (15 minutes real time) to repay a $2000 debt on the vehicle. You start with the van, a pair of refrigerated boxes, 18 gallons of gasoline, and $100 to $150 in cash.

After you enter your last name, a seven-option menu appears. Option one yields the assets report, an evaluation of your cash on hand, savings at Sentry Bank, automobile efficiency, and the amount of gas in your tank. The report also shows the wholesale and retail values of ice cream products in your inventory.

The source of your refreshments is Johnson's Dealership. For later sale you can purchase shortcake, fudge bars, vanilla bars, almond bars, big wheels, and creamsicles. To win the game you must eventually handle the more expensive products: fudge sundaes, banana splits, and birthday cakes. Not all products will be available every week. If you are in the Purchase Product menu and don't want to buy anything, entering 0 will return you to the main menu. The two refrigerated boxes fitted for your vehicle hold up to 200 units of one type of product each. At the end of any turn you may purchase an additional receptacle; the price varies from $60 to $400.

In addition to handling merchandise, you must manage vehicle fuel and repairs. The navigation command lets you target street blocks for vending, at a maximum of two blocks per gallon of gasoline. If the assets report shows auto ef-

Ice Cream Van sample run.

```
Williams Refreshment Service, Day 1

1 Assets report    5 Automobile report
2 Navigate         6 Take van invty
3 Visit Johnson's  7 Work your route
4 Visit Sentry Bank

Select Option? 1

            Cash: $    8.50
    Savings Acct: $    0.00
  Ice Wsale Cost: $ 137.50
Ice Retail Value: $ 359.05
 Auto Efficiency: 100%
            Fuel: 18 gal.
Press SPACE to continue.

Williams Refreshment Service, Day 1

1 Assets report    5 Automobile report
2 Navigate         6 Take van invty
3 Visit Johnson's  7 Work your route
4 Visit Sentry Bank

Select Option? 2

The vehicle can cover 2 street blocks
per gallon of gasoline.
You have 18 gallons.
Current price is $1.18/gal.
How many gallons will you buy? 7
How many blocks will you cover? 50


Williams Refreshment Service, Day 1

1 Assets report    5 Automobile report
2 Navigate         6 Take van invty
3 Visit Johnson's  7 Work your route
4 Visit Sentry Bank

Select Option? 7
Sales Results
44% of box 1 sold.
Profit $ 66.79
39% of box 2 sold.
Profit $ 27.20
Press SPACE to continue.
```

Listing 1.

```
1010 'ICE CREAM VAN
1020 'copyright(c)1985 Steven Williams
1030 GOSUB1050:GOSUB1120:CLEAR:GOTO1030
1040 'Initialize
1050 CLS:SCREEN0,0:DIMAT$(5,3),BX$(5,4),
FS$(9,4),T(4):DEFSNGA-Z
1060 FORX=1TO5:FORY=1TO3:READAT$(X,Y):NE
XTY,X
1070 FORX=1TO9:FORY=1TO3:READFS$(X,Y):NE
XTY,X
1080 PRINT" 1 Play Ice Cream Van"
1090 PRINT" 2 Exit to Menu":PRINT:PRINT"
 Select Option"
1100 I$=INKEY$:IFI$="2"THENMENUELSEIFI$=
"1"THENRETURNELSE1100
1110 'Simulation
1120 GOSUB1190
1130 GOSUB1490:GOSUB1880:GOSUB1750:IFD<2
1THEN1130
1140 CLS:PRINT" Your 21 days have expire
d.":SOUND9394,10:SOUND11172,60:GOSUB1850
:GOSUB1210:GOSUB1850
1150 CLS:X=C+S:IFX>=2000THENPRINT" You p
aid off the van! Congratulations!":PRINT
" Your rank:"INT(X/500)
1160 IFX<2000THENPRINT" Sorry, you did n
ot pay off the van.":PRINTUSING" You cam
e $#####.## short.";2000-X:IFX>1499THENPR
INT" You came close."
1170 GOSUB1850:RETURN
1180 'Human Element
1190 CLS:INPUT" Enter your last name";A$
:FORX=1TOVAL(RIGHT$(TIME$,2)):C=INT(RND(
1)*50)+100:NEXTX:G=18:B=100:P=2:RETURN
1200 'Assets
1210 CLS:X=0:Y=0:FORZ=1TO5:X=X+VAL(BX$(Z
,3)):Y=Y+VAL(BX$(Z,4)):NEXTZ
1220 PRINTTAB(13)USING"Cash: $#####.##";C
:PRINTTAB(5)USING"Savings Acct: $#####.##
";S
1230 PRINTTAB(3)USING"Ice Wsale Cost: $#
###.##";X:PRINTUSING" Ice Retail Value:
$#####.##";Y
1240 PRINTUSING"  Auto Efficiency: ###%"
;B
1250 PRINTTAB(13)"Fuel:"G"gal.":RETURN
```

ficiency below 100%, your van has been the victim of one of five mechanical failures. The auto report command lets you pay for repairs—$20 to $204—at any time after failure occurs. Efficiency is an important factor in profit calculations.

For game purposes, Sentry Bank pays 6% weekly interest on your account balance. Money deposited in the bank, however, isn't available for spending on additional boxes or advertising at the end of turn.

After you have prepared for the day—purchased ice cream, determined the length of your route, visited the bank, and noted any problems with your van—you are ready to work your route. For each refrigerated box, a percentage sale is calculated. Driving a short route and not placing any advertising will result in sales of about 5% of your inventory. You can place an advertisement in the local paper any week up to the fifteenth week. The effect of advertising is cumulative as you gain recognition in the community; each ad will increase your sales by about 5% per week.

At the end of 21 weeks, you receive a final assets statement and, if you have met or exceeded the $2000 goal, a performance ranking from 1 to 10. Remember that the sum of your cash and savings, not the value of your ice cream inventory, determines whether you reach the goal. In any case, if a box of shortcake remains, you could throw one heck of a party.

As in real life, success in Ice Cream Van is difficult to achieve. After a dozen unsuccessful summers, you may be convinced it is not possible to win the game. But be persistent. Make notes of things that seem to work and those that don't. Remember that the strategy you use at first will probably have to be modified as you progress through the summer. It *is* possible to pay off your van and have a small surplus to boot. Good selling! ■

Listing 1. *(continued)*

```
1260 'Auto
1270 CLS:IFV=0THENPRINT" No automobile t
rouble.":RETURN
1280 Y=V:PRINTUSING" You are now operati
ng at ##%";B:PRINT" efficiency because o
f"V"unattended":PRINT" repair(s)."
1290 FORX=1TOV:PRINT" "AT$(T(X),1)".":K=
VAL(AT$(T(X),3)):PRINTTAB(5)USING" Cost
to repair is $###.";K
1300 IFK>CTHENPRINT" You can't afford th
at repair now.":GOTO1330ELSEPRINT" Repai
r? (Y or N)"
1310 I$=INKEY$:IFI$="N"ORI$="n"THEN1330E
LSEIFI$<>"Y"ANDI$<>"y"THEN1310
1320 C=C-K:B=B+VAL(AT$(T(X),2)):PRINT" R
epair successful. Now at"B"%":T(X)=0:V=V
-1
1330 NEXTX:FORZ=1TO3:IFT(Z)=0ANDY>Z-1THE
NT(Z)=T(Z+1):T(Z+1)=0
1340 NEXTZ:RETURN
1350 'Bank
1360 CLS:INPUT" Deposit what amt";X:IFX>
CORX<0THEN1360ELSEC=C-X:S=S+X
1370 INPUT" Withdraw what amt";X:IFX>SOR
X<0THEN1370ELSES=S-X:C=C+X:RETURN
1380 'Navigation
1390 CLS:PRINT" The vehicle can cover 2
street blocks":PRINT" per gallon of gaso
line.":IFG=0ANDC+S<1.5THENG=1
1400 PRINT" You have"G"gallons.":PRINTUS
ING" Current price is $#.##/gal.";N2
1410 INPUT" How many gallons will you bu
y";X:IFX<0ORX<>INT(X)ORN2*X>CTHEN1410
1420 IFG+X>25THENPRINT" Maximum 25 gal."
:GOTO1410ELSEC=C-N2*X:G=G+X
1430 INPUT" How many blocks will you cov
er";BL:IFBL>2*GORBL<0ORBL<>INT(BL)THEN14
30
1440 RETURN
1450 'Inventory
1460 CLS:PRINT" Box"TAB(9)"Contents"TAB(
21)"Qty"TAB(26)"Wsale"
1470 FORX=1TOP:PRINTXTAB(9)BX$(X,1)TAB(2
0)INT(VAL(BX$(X,2)))TAB(25)USING"###.##"
;VAL(BX$(X,3)):NEXTX:RETURN
1480 'Variables by Day
1490 CLS:FORX=1TO9:IFINT(RND(1)*2)+1>1TH
ENFS$(X,4)=STR$(RND(1)*300)ELSEFS$(X,4)=
"0"
1500 NEXTX:N2=RND(1)*.5+1:D=D+1:S=S+S*.0
6:BL=0
1510 IFINT((50-D)*RND(1))>2ORV=3THEN1540
1520 J=INT(RND(1)*5)+1:X=0:FORY=1TO3:IFT
(Y)=JTHENX=1
1530 NEXTY:IFX=1THEN1520ELSEV=V+1:T(V)=J
:B=B-VAL(AT$(J,2))
1540 RETURN
1550 'Purchase
1560 CLS:PRINT" Mr. Johnson's Dealership
":PRINT
1570 PRINT" 1 Examine list of available
products":PRINT" 2 Purchase products"
1580 PRINT" 3 Return to Ice Cream Van me
nu":PRINT:PRINT" Select Option"
1590 I$=INKEY$:X=VAL(I$):IFX=0ORX>3THEN1
590ELSEIFX=3THENRETURN
1600 CLS:PRINT" Product"TAB(15)"Qty"TAB(
21)"Wsale"TAB(30)"Retail"
1610 FORZ=1TO9:IFFS$(Z,4)="0"THEN1640
1620 PRINTUSING" #";Z;:PRINT") "FS$(Z,1)
TAB(15)USING"###";VAL(FS$(Z,4));
1630 PRINTTAB(21)USING"#.##";VAL(FS$(Z,2
));:PRINTTAB(30)USING"#.##";VAL(FS$(Z,3)
)
1640 NEXTZ:IFX=1THENGOSUB1850:GOTO1560
1650 INPUT" Purchase which number";X:IFX
<0ORX<>INT(X)ORX>9THEN1650ELSEIFFS$(X,4)
="0"THEN1650
1660 IFX=0THEN1560ELSEPRINT" How many un
its of "FS$(X,1);
1670 INPUTU:IFU*VAL(FS$(X,2))>CORU>VAL(F
S$(X,4))ORU<0ORU<>INT(U)THEN1660
1680 IFU=0THEN1560ELSEINPUT" Place in wh
ich box";Z:IFZ=0THEN1560
1690 IFZ<0ORZ>PORINT(Z)<>ZTHENPRINT" You
 own"P"refrigerated boxes.":GOTO1680ELSE
N=VAL(BX$(Z,2))
1700 IFU>200-NTHENPRINT" Not enough room
 in that box.":GOTO1680
1710 IFN<>0ANDBX$(Z,1)<>FS$(X,1)THENPRIN
T" That box contains a different food.":
GOTO1680
1720 BX$(Z,1)=FS$(X,1):BX$(Z,2)=STR$(N+U
):BX$(Z,3)=STR$(VAL(BX$(Z,3))+U*VAL(FS$(
X,2)))
1730 BX$(Z,4)=STR$(VAL(BX$(Z,4))+U*VAL(F
S$(X,3))):FS$(X,4)=STR$(VAL(FS$(X,4))-U)
:C=C-U*VAL(FS$(X,2)):GOTO1560
1740 'Sales Results
1750 CLS:PRINT" Sales Results":PRINT:FOR
X=1TOP:CH=B/100*(INT(RND(1)*BL)+5*AD+5):
IFCH>95THENCH=100
1760 IFVAL(BX$(X,2))=0THENCH=0
1770 Y=CH/100*VAL(BX$(X,4)):Z=Y-CH/100*V
AL(BX$(X,3)):PRINTUSING"###% of box # so
ld.";CH,X:PRINTUSING" Profit $###.##";Z:
C=C+Z
1780 BX$(X,4)=STR$(VAL(BX$(X,4))-Y):N=VA
L(BX$(X,2)):BX$(X,2)=STR$(INT(N-CH/100*N
)):IFVAL(BX$(X,2))=0THENBX$(X,1)="":BX$(
X,4)="0":CH=100
1790 BX$(X,3)=STR$(VAL(BX$(X,3))*(1-CH/1
00)):NEXTX:GOSUB1850:G=G-BL*.5:U=60+(C+S
+1)/9
1800 IFC<UORP>4THEN1820ELSEPRINT" Would
you like to buy a refrigerated":PRINTUSI
NG" box for $###? (Y or N)";U
1810 I$=INKEY$:IFI$="Y"ORI$="y"THENC=C-U
:P=P+1ELSEIFI$<>"N"ANDI$<>"n"THEN1810
1820 IFC<25ORD>15THEN1840ELSEPRINT" Woul
d you like to spend $25 on":PRINT" adver
tising? (Y or N)"
1830 I$=INKEY$:IFI$="Y"ORI$="y"THENC=C-2
5:AD=AD+1ELSEIFI$<>"N"ANDI$<>"n"THEN1830
1840 RETURN
1850 PRINT" Press SPACE to continue."
1860 I$=INKEY$:IFI$=" "THENRETURNELSE186
0
1870 'Menu
1880 CLS:PRINT" "A$" Refreshment Service
, Day"D:PRINT
1890 PRINT" 1 Assets report"TAB(19)"5 Au
tomobile report"
1900 PRINT" 2 Navigate"TAB(19)"6 Take va
n invty"
1910 PRINT" 3 Visit Johnson's"TAB(19)"7
Work your route"
1920 PRINT" 4 Visit Sentry Bank":PRINT:P
RINT" Select Option";
1930 I$=INKEY$:W=VAL(I$):IFW=0ORW>7THEN1
930
1940 IFW=7THENIFBL=0THENCLS:PRINT" You m
ust vend at 1 block min.":PRINT" Use opt
ion 2.":GOSUB1850:GOTO1880ELSERETURN
1950 ONWGOSUB1210,1390,1560,1360,1270,14
60:IFW>1ANDW<5THEN1880
1960 GOSUB1850:GOTO1880
1970 DATA Battery failure,10,52,Baseball
-smashed windshield,20,143
1980 DATA Bent front fender,10,204,Broke
n headlights,20,25
1990 DATA Severed engine belt,35,47
2000 DATA Shortcake,.2,.7,Fudge Bar,.16,
.6
2010 DATA Vanilla,.11,.4,Almond Bar,.16,
.72
2020 DATA Big Wheel,.3,.87,Creamsicle,.1
,.25
2030 DATA Fud Sundae,.5,1.8,Ban Split,.9
5,2.33
2040 DATA Bir Cake,2.2,6.85
```

Correlation Analysis

A statistical test for relationships between two sets of data/**W. Michael Childress**

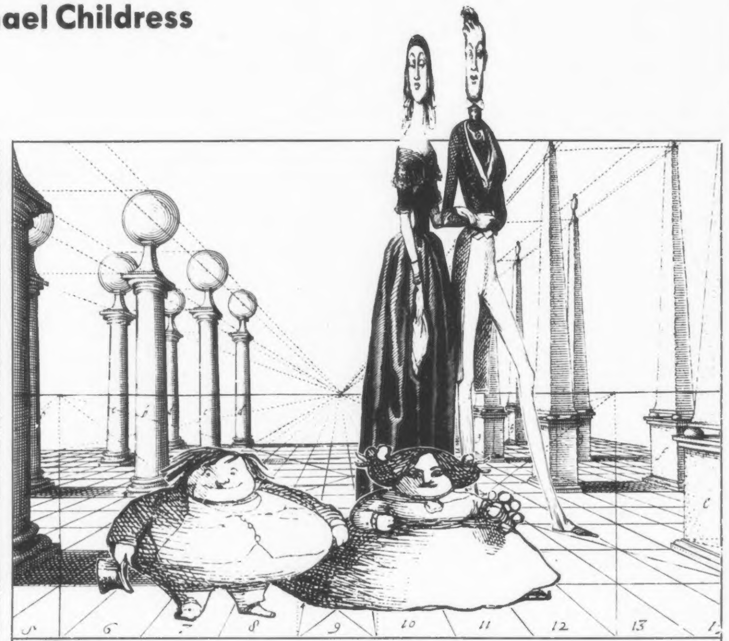
Suppose you find yourself asking a question like one of the following:

- You have lists of heights and weights for a group of ten people. Right off hand you would think that taller people are usually heavier than shorter people, but there are some tall slender people and some short pudgy people in the group. Can you say that for the group (or for any group with height and weight for each person), taller people are heavier and shorter people are lighter?
- In your local tavern, you get into a discussion about football teams. You contend that teams with better defenses (points allowed) tend to win more games, while your buddy contends that offense is the key to a better won-lost record. Who is right, or are you both right, or are you both wrong?
- Two teachers are asked to independently rank students in a class from first to last according to how good a student they perceive each person to be. Are the rankings consistent between the teachers, or do the teachers have different perceptions about who the good students are?

If you have faced such questions and don't know exactly how to approach them, your personal computer can once again come to your assistance. The appropriate approach for these examples is correlation analysis, and small computers are ideal tools for performing all the necessary calculations.

Correlation analysis is a family of statistical tests to determine mathematically whether there are trends or relationships between two or more sets of data from the same list of items or individuals (for example, heights and weights of people). The tests provide a statistical yes or no as to whether a significant relationship or correlation exists between the variables (for example, there is a significant tendency for taller people to be heavier).

A correlation test consists of calculating a correlation coefficient from the two data sets (a data set might be a list of heights, for example) and then comparing this coefficient to an appropriate entry in a table of correlation coefficient criterion numbers.



Correlation analysis is a family of statistical tests to determine mathematically whether there are trends or relationships between two or more sets of data from the same list of items or individuals.

The entry or criterion is selected according to the number of items or data pairs in the set (10 in the heights and weights example, 28 in the case of NFL teams). If the coefficient is greater than or equal to the selected criterion, then there is a significant correlation or relationship between the two data sets. Details of the correlation tests and the strict meaning of significance are described in the sidebar.

The program presented in Listing 1 will conduct a correlation test on data that you enter by pairs for each item or individual. The program prompts data input, calculates the appropriate coefficient, compares the coefficient to the appropriate table criterion (stored in an array), and then presents the results as a yes or no answer.

This program considers correlations between exactly two sets of data (heights and weights, or points scored and number of wins). The data in the sets do not have to be strictly numerical data such as counts or measurements, however. Two types of correlation coefficients can be calculated by the program.

The first is used when the two sets of data are both numerical data—number of inches high, number of pounds, number of points scored, and number of wins. The second is used when one or both sets of data are rankings—from first to however many items are on the list. For example, the tallest person in the group would be 1, the next tallest 2, and so on to the shortest person at number 10. Similarly, football teams could be ranked according to won-lost records from 1 to 28.

The use of ranking data requires use

Listing 1.

```
100  REM
102  REM    CORRELATION ANALYSIS
104  REM
200  REM  DATA INPUT SEGMENT
202  REM
210  HOME : PRINT "CORRELATION ANALYSIS"
220  PRINT : PRINT "ENTER NUMBER OF ITEMS:"
230  INPUT "(3 TO 102):  ";N
240  DIM A(N),B(N),AA(40)
245  PRINT
250  PRINT "ARE DATA RANKS OR NUMERICAL"
260  INPUT "    (R OR N)?  ";N$
300  FOR J = 1 TO N
310  PRINT : PRINT "ITEM NUMBER ";J
320  INPUT "FIRST VARIABLE:  ";A(J)
330  INPUT "SECOND VARIABLE:  ";B(J)
340  NEXT J
360  PRINT : PRINT "DATA INPUT COMPLETE"
370  PRINT "PRESS <RETURN> TO CONTINUE."
380  INPUT AN$
390  HOME : PRINT "CALCULATING"
400  REM
402  REM    CORRELATION CALCULATIONS SEGMENT
404  REM
410  IF N$ = "R" THEN  GOTO 500
419  REM
420  REM  PRODUCT-MOMENT CORRELATION COEFFICIENT
422  REM
430 SA = 0:SB = 0:A2 = 0:B2 = 0:AB = 0
440  FOR J = 1 TO N
445 SA = SA + A(J)
450 SB = SB + B(J)
455 A2 = A2 + A(J) * A(J)
460 B2 = B2 + B(J) * B(J)
465 AB = AB + A(J) * B(J)
470  NEXT J
475 A2 = A2 - (SA * SA) / N
480 B2 = B2 - (SB * SB) / N
485 AB = AB - (SA * SB) / N
490 R = AB /  SQR (A2 * B2)
495  GOTO 600
500  REM
502  REM  RANK CORRELATION COEFFICIENT
504  REM
510 D2 = 0
520  FOR J = 1 TO N
530 D2 = D2 + (A(J) - B(J)) * (A(J) - B(J))
540  NEXT J
550 R = (N - 1) * N * (N + 1)
560 R = 1 - (6 * D2) / R
600  REM
602  REM   CORRELATION CRITERION SEGMENT
604  REM
610  REM   READ CRITERIA DATA INTO ARRAY
620  FOR J = 1 TO 39
625  READ AA(J)
630  NEXT J
640  DATA  0.997, 0.950, 0.878, 0.811, 0.754
645  DATA  0.707, 0.666, 0.632, 0.602, 0.576
650  DATA  0.553, 0.532, 0.514, 0.497, 0.482
655  DATA  0.468, 0.456, 0.444, 0.433, 0.423
660  DATA  0.413, 0.404, 0.396, 0.388, 0.381
665  DATA  0.374, 0.367, 0.361, 0.355, 0.349
670  DATA  0.325, 0.304, 0.288, 0.273, 0.250
675  DATA  0.232, 0.217, 0.205, 0.195
700  REM  DETERMINE TABLE ENTRY (DF)
710  IF N > 91 THEN DF = 39
715  IF N > 81 THEN DF = 38
720  IF N > 71 THEN DF = 37
725  IF N > 61 THEN DF = 36
730  IF N > 51 THEN DF = 35
735  IF N > 46 THEN DF = 34
740  IF N > 41 THEN DF = 33
745  IF N > 36 THEN DF = 32
750  IF N > 31 THEN DF = 31
755  IF N < 32 THEN DF = N - 2
770  HOME
800  REM
802  REM   CORRELATION TEST SEGMENT
804  REM
810  IF R >  = AA(DF) THEN  GOTO 900
820  IF R <  =  - (AA(DF)) THEN  GOTO 950
850  REM   NO SIGNIFICANT CORRELATION
860  PRINT : PRINT "NO SIGNIFICANT CORRELATION
870  PRINT "FOUND BETWEEN VARIABLES."
880  GOTO 1000
900  REM  POSITIVE CORRELATION
910  PRINT : PRINT "SIGNIFICANT POSITIVE CORRELATION"
920  PRINT "FOUND BETWEEN VARIABLES"
930  GOTO 1000
950  REM  NEGATIVE CORRELATION
960  PRINT : PRINT "SIGNIFICANT NEGATIVE CORRELATION"
970  PRINT "FOUND BETWEEN VARIABLES"
1000  REM
1002  REM   CALCULATION RESULTS DISPLAY SEGMENT
1004  REM
1010  PRINT : PRINT
1020  PRINT "NUMBER OF ITEMS = ";N
1030  PRINT "CORRELATION COEFFICIENT = ";R
1040  PRINT "DEGREES OF FREEDOM = "N - 2
1050  PRINT "CRITERION = ";AA(DF)
1100  END
```

of a special coefficient (Spearman's coefficient of correlation), so the program specifically asks what type of data you will enter. If one set of data is ranks, then the second set must also be in ranks. This requires that you convert the second variable data into ranks before entering them into the computer.

Ties in rankings are simply resolved by using the average ranking for all items tied for that rank. For example, if two people are tied for the third rank slot at six feet tall, the rank used in the correlation test would be the average of the two rank slots 3 and 4, or 3.5. It is not necessary that you enter the data for each item in sequence according to rankings, just that the rank number for each item reflect its ranking in the total list of items for that variable or data set.

Two more notes about correlations are important. First, significant correlations can be positive or negative. A positive correlation indicates that when one attribute (height) increases, the other also tends to increase (weight). In the height-weight example, this would indicate that taller people are heavier and shorter people are lighter. A negative correlation indicates that as one attribute (height) increases, the other (weight) decreases; that is, taller people tend to be lighter, and shorter people to be heavier. The program shown above will determine whether the data entered indicate a significant positive correlation, a significant negative correlation, or no significant correlation.

The other note is that the correlation test in the program specifically tests for straight-line correlations. If the data are actually related in a non-linear relationship (i.e., not $y=a+m*x$, but something like $y=a*x*x$ or some other curvilinear relationship), then the correlation test will probably not be able to detect it. Testing for non-linear relationships steps up into intermediate statistics and is far beyond the scope of this program. Such tests can be found in most intermediate statistics texts.

Correlation Program

The correlation test program is presented in Listing 1. The Basic used is AppleSoft for an Apple II or III. This code should be very easy to convert to

Correlation Analysis and Statistical Tests

Correlation analysis, one of the most important concepts in statistics, is given central attention in all statistics texts. The detailed theory of correlations is not presented here, because this is available abundantly elsewhere. Instead the objective is to note the specific tests conducted by the program presented in the article.

The term *significant correlation* in the context of the program presented in this article does not necessarily mean that the two sets of data are directly and completely related, that is, that no variation in either set of data occurs except directly as a result of variations in the other. Instead a significant correlation indicates that a fairly consistent trend is evident between the data sets. A set of data could, in fact, be correlated with any number of other data sets. Further, a significant correlation does not "prove" a cause-and-effect relationship between the two sets of data, only that there are similar trends in the variation of the data sets.

The *test* concept used in correlation analysis is also not a 100% certainty. The test conducted in the program uses a 95% level of confidence for the criterion numbers. This means that if the calculated coefficient exceeds the criterion, the data are 95% likely to have a significant relationship. The remaining 5% likelihood covers purely coincidental similarities in the two data sets. In other words, there is a 1 in 20 chance that the program would decide that there was a significant correlation, when in fact the trend was only a coincidental similarity and not a true relationship at all.

The correlation test used for numerical data employs a product-moment correlation coefficient. The number is calculated using a fairly complex statistical formula:

$$R = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{N}}{(\Sigma X^2 - \frac{(\Sigma X)^2}{N})*(\Sigma Y^2 - \frac{(\Sigma Y)^2}{N})}$$

where X and Y are the values for the two sets of data, and

$$\Sigma X = \overset{N}{\underset{i=1}{\Sigma}} X_i = X_1 + X_2 + X_3 + \ldots + X_N$$

The program calculates the coefficient in steps to avoid long equations in the Basic code. The calculated number will lie between—1 and 1, inclusive. The coefficient is then compared to the correlation coefficient criterion for the appropriate degrees of freedom (DF =N—2) as a test for positive correlation. If the test fails, the coefficient is compared to the negative of the criterion. If the coefficient is less than the criterion, then a negative correlation is demonstrated.

The rank correlation coefficient used in the program is Spearman's coefficient of correlation:

$$R = \frac{6\Sigma(X-Y)^2}{(N-1)(N)(N+1)}$$

This coefficient is tested in the same manner as the product-moment correlation coefficient.

other Basics as needed. The listing is divided into segments for clarity and for ease in making enhancements.

The data input segment runs from lines 200 to 400. In this segment, the program asks you to enter the number of items N, the data type (ranks or numerical), and then, using a FOR loop, each data pair. Data are stored in two arrays A and B, which are dimensioned to size N in line 240. When the data are all entered, the program displays a CALCULATING message while all coefficient calculations and tests are proceeding.

The next segment runs from lines 400 to 600, and includes the correlation coefficient calculations. If numerical data are entered, then the product-moment coefficient is calculated in lines 420 to 495. The calculations are derived from the equations described in the sidebar. If the data are rankings, the rank correlation coefficient is calculated in lines 500 to 560. In either case, the product produces a coefficient R.

The coefficient must be compared to a criterion number which is appropriate for the number of items in the data lists. A series of criteria for various numbers of items is loaded into array AA in the correlation criterion segment, lines 600 to 770. The program selects the criterion for this set of data in lines 700 to 755, based on the number of items.

The actual comparison of the coefficient with the criterion and the display of test results occurs in the correlation test segment, lines 800 to 970. In line 810, the coefficient is tested for a positive correlation, and for a negative correlation in the next line. If the coefficient does not pass either test, then no significant correlation exists. The final segment is the calculation results display beginning in line 1000. Here the coefficient and criterion are displayed as explanation for the test conclusions.

Correlation Examples

An example set of data for the correlation tests is given in Table 1. These are heights and weights for the first ten players on a football roster from 1982. The players in this case are the items, and height and weight are the two data sets that will be tested for a correlation. Both the actual height/weight numerical and ranking data are given for these individuals so that correlation tests can be performed for numerical and ranked data sets. Note that ties in height rankings were resolved by using average rankings for the tied items.

The correlation test program was

Table 1. Height-Weight Correlation Example.

Item	Height		Weight	
Number	Inches	Rank	Pounds	Rank
1	73	8	203	7
2	77	2.5	249	2
3	74	6.5	223	5
4	76	4	228	3
5	75	5	198	8
6	71	10	189	9
7	77	2.5	263	1
8	78	1	226	4
9	74	6.5	222	6
10	72	9	175	10

```
CORRELATION ANALYSIS

ENTER NUMBER OF ITEMS:
(3 TO 102):  10

ARE DATA RANKS OR NUMERICAL
     (R OR N)?  N

ITEM NUMBER 1
FIRST VARIABLE:  73
SECOND VARIABLE:  203

ITEM NUMBER 2
FIRST VARIABLE:  77
SECOND VARIABLE:  249

ITEM NUMBER 3
FIRST VARIABLE:  74
SECOND VARIABLE:  223

ITEM NUMBER 4
FIRST VARIABLE:  76
SECOND VARIABLE:  228

ITEM NUMBER 5
FIRST VARIABLE:  75
SECOND VARIABLE:  198

ITEM NUMBER 6
FIRST VARIABLE:  71
SECOND VARIABLE:  189

ITEM NUMBER 7
FIRST VARIABLE:  77
SECOND VARIABLE:  263

ITEM NUMBER 8
FIRST VARIABLE:  78
SECOND VARIABLE:  226

ITEM NUMBER 9
FIRST VARIABLE:  74
SECOND VARIABLE:  222

ITEM NUMBER 10
FIRST VARIABLE:  72
SECOND VARIABLE:  175

DATA INPUT COMPLETE
PRESS <RETURN> TO CONTINUE.
?
CALCULATING

SIGNIFICANT POSITIVE CORRELATION
FOUND BETWEEN VARIABLES


NUMBER OF ITEMS = 10
CORRELATION COEFFICIENT=.805949301
DEGREES OF FREEDOM = 8
CRITERION = .632
```

Figure 1.

```
CORRELATION ANALYSIS

ENTER NUMBER OF ITEMS:
(3 TO 102):  10

ARE DATA RANKS OR NUMERICAL
     (R OR N)?  R

ITEM NUMBER 1
FIRST VARIABLE:  8
SECOND VARIABLE:  7

ITEM NUMBER 2
FIRST VARIABLE:  2.5
SECOND VARIABLE:  2

ITEM NUMBER 3
FIRST VARIABLE:  6.5
SECOND VARIABLE:  5

ITEM NUMBER 4
FIRST VARIABLE:  4
SECOND VARIABLE:  3

ITEM NUMBER 5
FIRST VARIABLE:  5
SECOND VARIABLE:  8

ITEM NUMBER 6
FIRST VARIABLE:  10
SECOND VARIABLE:  9

ITEM NUMBER 7
FIRST VARIABLE:  2.5
SECOND VARIABLE:  1

ITEM NUMBER 8
FIRST VARIABLE:  1
SECOND VARIABLE:  4

ITEM NUMBER 9
FIRST VARIABLE:  6.5
SECOND VARIABLE:  6

ITEM NUMBER 10
FIRST VARIABLE:  9
SECOND VARIABLE:  10

DATA INPUT COMPLETE
PRESS <RETURN> TO CONTINUE.
?
CALCULATING

SIGNIFICANT POSITIVE CORRELATION
FOUND BETWEEN VARIABLES


NUMBER OF ITEMS = 10
CORRELATION COEFFICIENT=.836363636
DEGREES OF FREEDOM = 8
CRITERION = .632
```

Figure 2.

run twice, once for the numerical data and again for the ranking data. Results from these tests are shown in Figures 1 and 2. Figure 1 shows the program run with the numerical height/weight data. The resulting correlation coefficient was about 0.8059, which exceeds the criterion number 0.632. This indicates a significant positive correlation; taller players tend to be heavier and shorter players tend to be lighter. Figure 2 uses the rankings of these data in another program run. The resulting rank correlation coefficient, 0.8363, is close to the other coefficient and also indicates a significant positive correlation. This is expected since the rankings were derived from the numerical data.

These examples indicate that rankings can provide a basis for statistical tests on data that may have very subjective evaluations, such as the "good student" example at the beginning of this article. As long as a numbered rank can be assigned to both attributes, the rank correlation should be applicable for almost any situation.

Program Enhancements

The program as listed is designed to be short and simple. A variety of enhancements can be made to increase its power and utility. Some suggestions are listed below.

- Increase the number of data points that can be considered. This will require additional criteria for larger numbers of items. These are available in most statistics texts for numbers of items up to and over 1000. Fortunately, the criteria do not change much for numbers greater than 1000.
- Save the data on disk after input. To keep this program as general as possible, I have not included any disk commands. However, it would be very easy to store the data on a disk since the data are already organized into arrays. This could be a subroutine option which the program would ask about immediately after all data were entered.
- Use data from a disk. Instead of entering the data by hand for each test, you could easily have the program input the data from a disk into the arrays A and B. This might be another program option, so that you could select from alternative sources of data.
- Display entered data. Once entered or read from a disk, the data could be displayed in a table on the monitor, or could be sent to a printer for a formatted printout. The results of the correlation test could also be sent to the printer for a permanent copy. The sample runs in Figures 1 and 2 were derived by diverting all monitor displays to the printer. On an Apple II, this involves entering PR#1, or whatever slot number your printer card is in, then running the program.
- Convert the program into a subroutine. This program can be easily renumbered by hand or using an appropriate utility, and put into any program for ready access. Two things to be very careful of in this case are using variables that are used elsewhere in the main program and redimensioning arrays if the subroutine is used more than once.
- Include the program in a statistical package. This is something you should consider very seriously. Calculating means and variances is a snap for beginning programmers, and more complex statistical calculations can be obtained both from elementary statistics books and articles like this one in various personal computing magazines. Other good programs to be included would be plotting and graphing routines which would show you how the data looked as well as performing tests. All these could be included on one disk for your own data analyses, especially if you included a menu program that would run the programs as selected. ■

APPLE CART

Apple's troubled times, amazing II products, contest winners, color Mac coming?/**Owen Linzmayer**

If, for some reason, we make some giant mistakes and IBM wins, my personal feeling is that we are going to enter sort of a computer Dark Ages for about 20 years.
—Steven Jobs, in Playboy *magazine.*

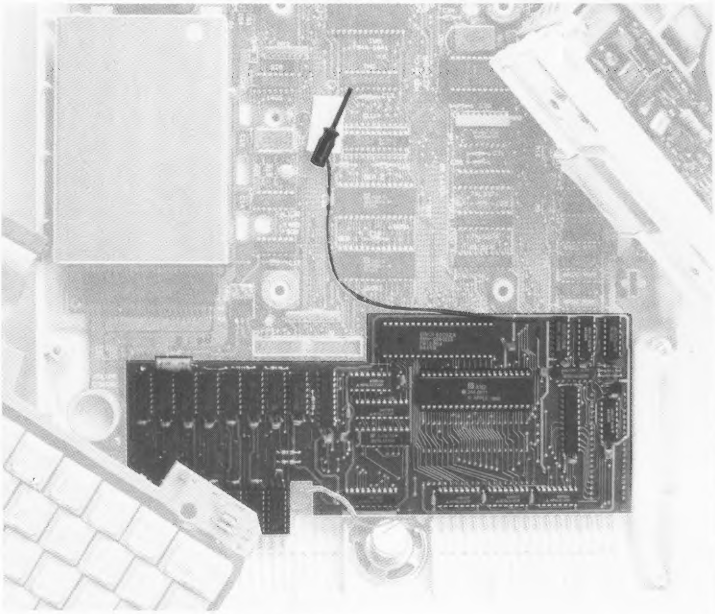
On May 31, citing declining sales and the need to cut costs, Apple president John Sculley announced a company-wide reorganization that cost the jobs of 1200 employees and forced charismatic co-founder Steve Jobs to relinquish most of his responsibility for day-to-day operations. While it is far too early to tell if the reorganization will prove successful, my belief is that it can only help.

The time has come for Apple to be run by professional, not entrepreneurial, managers. If Apple really wants to compete with IBM, undeniably the best managed company on this planet, it must accept its role as a legitimate business. The trick will be for Apple to retain the freewheeling, innovative spirit upon which it was built as it makes the transition to big business. His ego and idiosyncrasies aside, Jobs did a tremendous job of bringing the Mac to market and is well suited to his new role as "the creator of powerful ideas and the champion of Apple's spirit." Let's hope that his position is more than that of an impotent figurehead.

Apple needs the credibility the new management reorganization brings with it. Preceding the power politics, we saw Apple all but abandon the venerable II line in favor of the more stylish Mac. Owners and dealers alike began questioning Apple's commitment to the Apple II product line. Wozniak's leaving Apple in the spring only served to confirm everyone's worst suspicions.

Amidst the doom and gloom prophecy of a hostile corporate takeover, I am encouraged by the reunion of the Macintosh and Apple II divisions. According to Sculley, Apple is being reorganized along the functional lines of marketing and manufacturing.

Whenever you take a product-based company and restructure it functionally, there is bound to be a great deal of job overlap. It is this overlap that was trimmed by the staff cuts.



Photography by Jeff MacWright.

Z-RAM internal IIc board with Z-80 and 512K.

Another Hit

When I last wrote the Apple Cart column back in June, I told you about an internal CP/M card for the IIc from Applied Engineering. Not content to rest on their laurels, the folks from Carrollton, TX have scored another hit—not only can you have a Z80 coprocessor inside your IIc, you can add an additional 512K of RAM. Let's take a closer look at Z-Ram.

Z-Ram is 100% compatible with all IIc hardware and software. Available with either 256K or 512K of memory, Z-Ram is a printed circuit board about the size of the IIc keyboard under which it resides. Installation of the Z-Ram requires you to take the case off your IIc and remove the 65C02 and MMU chips from the motherboard. After placing them in their designated sockets on the Z-Ram card, you must insert the entire board into the two vacant sockets of the IIc. A short wire with a small plastic "grabber" on the end is then attached to pin 2 of the TMG chip to pick up necessary timing signals. If all goes well, this installation takes less than 10 minutes.

Unfortunately, the 65C02 socket on my IIc was too large which prevented the Z-Ram board from fitting snuggly into place. Although they assure me that I am an exceptional case (my mother has known that for years), I recommend that you have Applied Engineering install your Z-Ram if you are the least bit apprehensive and can afford to be without your computer while they install and test the product.

Once the board is installed, there is no visible indication of the raw computing power contained under the hood of your IIc. Z-Ram comes with three disks that unleash the tempest in your machine. The most useful disk is the Super AppleWorks Expander, which modifies Apple's popular integrated package so that it recognizes the extra memory in the Z-Ram card. Owners of the 256K version of Z-Ram can look forward to

AppleWorks desktops of 229K (compared to the standard 55K), and those with a 512K Z-Ram get an enormous 413K desktop on which to create a monster spreadsheet too large to be stored on one disk. You can even opt to modify your *AppleWorks* copy so that the entire program loads into memory. This adds two minutes to the initial boot time, but greatly reduces disk access during use. Just as *VisiCalc* once helped sell Apple IIs, *AppleWorks* should now help sell IIc computers equipped with Z-Ram.

The extra memory of the Z-Ram can also be used as a blindingly fast ramdrive. Applied Engineering includes a program disk for creating DOS 3.3, ProDOS, and Pascal ramdrives. Additionally, the CP/AM 4.0A system disk for use with the Z80 coprocessor on the Z-Ram has the appropriate software to utilize a ramdrive, although most IIc users will admittedly never use CP/M programs. It is entirely possible that Applied Engineering will soon offer a similar card with a real-time clock instead of a Z80 coprocessor. Now that is something to look forward to!

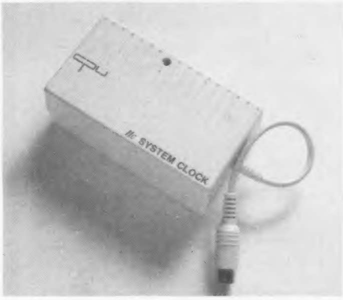
The documentation provided with Z-Ram is disappointing—at $449 for the basic 256K Z-Ram ($549 for the 512K model), Applied Engineering should provide a professionally typeset manual with thorough instructions on installation, troubleshooting, CP/M, and operation of the ramdrives. Instead, purchasers receive a poorly reproduced 30-page booklet filled with cursory explanations and references to other manuals and books that the average user may not own. Even so, I give Z-Ram a thumbs up recommendation. If you are addicted to *AppleWorks*, you'll love Z-RAM.

For you Apple IIe owners salivating at the very thought of the power of a Z-Ram, there is Ramworks, also from Applied Engineering. Ramworks plugs into the auxiliary slot of the IIe and provides from 64K to 1Mb (1000K) of on-board memory in addition to 80-column text capability. The basic card can be upgraded to a maximum of 512K, and with the help of piggyback cards you can add more memory and an RGB video interface.

Like Z-Ram, Ramworks comes complete with ramdrive and *AppleWorks* expanding software. Ramworks does not have a Z80 coprocessor, but Applied Engineering sells ramdrive software for use with other CP/M cards. Also available is a *VisiCalc* preboot program ($29). Without a doubt, *AppleWorks* running on a IIe with Ramworks and a Sider hard disk (see review August 1985) will be one of the most popular Apple II configurations for power users.

The Time of Day

Apple's newest disk operating system, ProDOS, was designed to let the II family grow beyond those severely limited 143K disk drives. Among its many improvements over DOS 3.3, ProDOS can accommodate time and date stamping of files, yet ironically, Apple did not build a real-time clock inside the ProDOS-based IIc. It has taken a long time for a third-party manufacturer to come up with a IIc clock, but I think you will agree it was worth the wait.



The IIc System Clock from Creative Peripherals Unlimited (CPU) comes in an attractive white box that stands 2" high, 2 3/4" wide and 5" long. Styled along the same lines as the IIc, the system clock plugs into either of the serial ports on the back of the computer but does not restrict access to that port. Printers and modems can be plugged into the back of the IIc system clock and will operate just as if the clock didn't exist. In the unlikely case that the system clock interferes with the normal operation of a serial device, you can simply bypass it by flipping a switch on the outside of the unit.

The IIc system clock is set via software. The clock may be purchased for $119.95 with *Time-Trax*, a menu-driven time management program that I reviewed in October of 1984. Briefly, *Time-Trax* is a calendar program that keeps track of appointments, birthdays, errands, and reminders. While it is a well-polished program, I am more interested in using the clock for time and date stamping of ProDOS files.

If you decide to buy the IIc system clock without *Time-Trax* you will pay only $79.95 and get a clock utilities program with which you can install the clock driver on any non-protected ProDOS volume that is bootable and has fewer than 51 files in the root directory and a minimum of five free blocks. This includes ramdrives and hard disks. When you boot a ProDOS volume on which you have installed the clock driver, a message to that effect appears, and from that point on the system recognizes the clock. This means that when you boot *AppleWorks*, for example, it will default to the correct date. Any files you copy using the IIc system utilities disk will automatically have the time and date stamped onto the directory of the destination disk.

CPU sells the IIc system clock for $79.95 with clock utilities software, a phillips head screw driver, two data disk labels, and a manual that describes how to use the clock from within your own programs. For $119.95, you get all that and the *Time-Trax* program. As always, three AA batteries are not included.

The Envelope Please

The deadline for the great Apple programming contest has long since passed. The entries have been evaluated and the prizes awarded. While space restrictions keep us from printing the listings of the winning programs, I would like to acknowledge the winners and thank everyone who took the time to submit programs. The names of the winners and their programs are shown in the table below.

Apple Cart Contest Winners

Name	**Program**	**Category**
Ronald A. Olansen	World Dynamics	Miscellaneous
John Calvin	Portfolio	Miscellaneous
Jim Newbury	Disk Directory	Utility
David Dreyer	Correct DOS	Utility
Paul Ens	Apple Paint	Graphics
Brian Johnson	Doctor Who database	Nonsense
Gen Kiyooka	Music Synthesizer	Nonsense
Tony Knorouzan	Stocks	Entertainment

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Most of the programs submitted are currently available for easy downloading on the *Creative Computing* SIG on CompuServe (type go pcs22 at any function prompt).

Color Mac: Second Sighting

John Anderson reported in May that a very reliable source had actually seen a color Macintosh computer. Now comes confirmation of the existence of such a beast, from none other than Steve Wozniak himself.

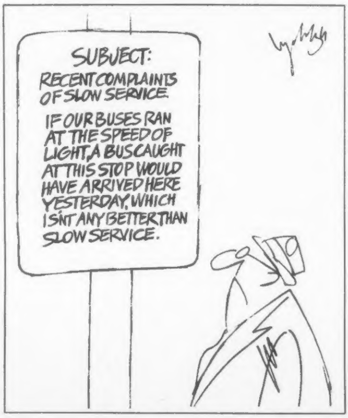
When an observant user noticed Woz poking around CompuServe's CB simulator early one Saturday morning, he struck up a conversation during the course of which Steve admitted that Apple does have plans to release a color version of the Mac.

While specifics were not disclosed, this report dovetails nicely with rumors that Apple will begin discounting the Mac line in time for the back-to-school buying season. Certainly Apple feels pressure from the Amiga (see story elsewhere in this issue) and the Atari ST, and a color Mac with its installed base of software is just the thing to keep Apple a step ahead of the rest. ■

Firms Mentioned In This Column

Applied Engineering
P.O. Box 798
Carrollton, TX 75006
(214) 241-6060

Creative Peripherals Unlimited
22952 Alcalde
Suite 160
Laguna Hills, CA 92653
(800) 228-1165
(800) 533-8997 in CA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	1. Own	2. Plan to Buy	
		1-6 months	7-12 months
IBM PC or compatible	A.	L.	W.
Apple II Series (II, IIc, IIe)	B.	M.	X.
Apple Macintosh	C.	N.	Y.
Commodore 64 or 128	D.	P.	Z.
Commodore Amiga	E.	Q.	1.
Atari XL, XE, ST	F.	R.	2.
Tandy/Radio Shack	G.	S.	3.
Any Laptop/portable	H.	T.	4.
Other (specify)	J.	U.	5.
None	K.	V.	6.

Please indicate which of the following peripherals you plan to buy either in the next 6 months or in the next 7-12 months.

	3. Plan to Buy	
	1-6 months	7-12 months
Hard disk drive	7.	14.
Dot matrix printer	8.	15.
Daisy wheel printer	9.	16.
Plotter	10.	17.
Monitor	11.	18.
Modem	12.	19.
Power protection device	13.	20.

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481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500

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4. Where do you use a computer?
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5. How many computers do you own?
24. ☐ 1 25. ☐ 2-3 ☐ 26. ☐ 3 or more

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	1. Own	2. Plan to Buy	
		1-6 months	7-12 months
IBM PC or compatible	A.	L.	W.
Apple II Series (II, IIc, IIe)	B.	M.	X.
Apple Macintosh	C.	N.	Y.
Commodore 64 or 128	D.	P.	Z.
Commodore Amiga	E.	Q.	1.
Atari XL, XE, ST	F.	R.	2.
Tandy/Radio Shack	G.	S.	3.
Any Laptop/portable	H.	T.	4.
Other (specify)	J.	U.	5.
None	K.	V.	6.

Please indicate which of the following peripherals you plan to buy either in the next 6 months or in the next 7-12 months.

	3. Plan to Buy	
	1-6 months	7-12 months
Hard disk drive	7.	14.
Dot matrix printer	8.	15.
Daisy wheel printer	9.	16.
Plotter	10.	17.
Monitor	11.	18.
Modem	12.	19.
Power protection device	13.	20.

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141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440
441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460
461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500

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4. Where do you use a computer?
21. ☐ Business 22. ☐ Home 23. ☐ School

5. How many computers do you own?
24. ☐ 1 25. ☐ 2-3 ☐ 26. ☐ 3 or more

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TANDY GRAM

Parameter passing saves work at RUN time

Jake Commander

This month we have a program that should interest most Color Computer and Model I/III/4 owners. This is a tricky way to use the RUN command to pass parameters to a Basic program when you issue the command to run. When you give any command to the Basic interpreter, whether or not it is preceded with a line number, the interpreter encodes that line and changes all the Basic keywords into tokens, doing so in its line input buffer. If you add a line number to a statement which is input to it, Basic simply tucks the whole line away into the current Basic program—sorting it into line-number order as it does so. Then Basic comes back to the prompt. If you don't put a line number at the front, the line is just encoded without a line number and executed immediately. This is exactly what happens when you give a RUN command. Basic sees that the letters R, U, and N spell out a keyword in its dictionary, and it replaces this command with a token, which is the number 142 (hexadecimal 8E) on the Color Computer and Model I/III/4.

To pass operating parameters to your program, all you have to do is place them at the end of the RUN command, causing them to be placed in the buffer along with the tokenized RUN keyword. Basic is even prepared for this kind of thing in its normal mode of operation—when you say RUN followed by a line number (like RUN 100), the interpreter uses the line number as a parameter. So as Basic does look to see if there is anything after the RUN command, any parameters passed may upset the interpreter if not sent correctly. This means that RUN must be terminated appropriately in the input buffer. Basic recognizes two situations that will prevent it from giving a syntax error. One is a line number as just discussed; the other is an end of statement.

Once you have an idea of what to look for after the RUN token, you can store any parameters in a long string containing the whole line's worth or you can separate them into substrings by using spaces as delimiters.

Now if we are going to pass any parameters, we obviously can't send an end of statement in the form of a return character immediately after RUN. But as Basic also treats a colon as an end of statement, all you have to do is type RUN, a colon, and some parameters, and Basic will be happy to take this as a non-syntax error and run your program with the parameters intact in the buffer. At this point we have an option as to how the rest of the parameters are passed. We can either pass them just as we want the program to see them so that if you had, for example, parameters ONE TWO THREE (separated by spaces and spelled out), you could just type

RUN:ONE TWO THREE

When using this method, the thing to be aware of is that Basic doesn't know that ONE, TWO, and THREE are parameters when it converts that input line into tokens. Thus, in that example, it would spot the first two letters of that ONE and see ON as in ON GOTO or ON GOSUB. It would therefore tokenize that ON. As long as you are aware of which tokens can possibly be encoded and can deal with those in your program, this is no problem.

Nonetheless it is something of a hassle to worry about the parameters you are passing being converted to tokens, so we could use a way to stop Basic from encoding any parameters at all. There is a method to do just this. It is accomplished with a REM statement or—even better for saving keystrokes—the apostrophe which is shorthand for REM. Any parameters you pass after this will remain untouched by the tokenizing process of the Basic interpreter. The only thing you now have to worry about is to make sure you don't try to type in parameters that will take up more than the 255-character length of logical line. So using this method, you could type

RUN'ONE TWO THREE

and your Basic program would (assuming it knew where to look) find the ONE, TWO, and THREE in the input buffer along with the RUN command that invoked your program in the first place.

Having taken a look at the theory, let's see how it works in practice. Both the Color Computer and Model I/III/4 use the same principle, but the address of the Basic input buffer differs for each one. Not only does it differ between the Color Computer and the others, but it can differ on the same Model I/III/4—depending on whether you are running under a disk or a non-disk Basic system. To facilitate this input buffer being moved, the Model I/III/4 stores a pointer to the Basic buffer in a special location in memory. This pointer is always stored at location 16551 (hexadecimal 40A7). By looking at this location, which is a Z80-type, two-byte pointer, you can find out where the RUN command that initiated your program is stored. One extra point: Basic shifts your input line downwards in the buffer so the RUN keyword appears at the buffer-start minus 1.

There is a slight difference on the Color Computer. The location of the input buffer on this machine is "hard-wired." Instead of an indirect pointer as on the Model I/III/4, the ROM in the Color Computer takes the input buffer to be at location 733 (hexadecimal 02DD) no matter which version of Microsoft Basic is being used. Also, the RUN keyword is aligned right at the buffer start.

A Closer Look

Now that you know where to look, you can scan the locations following the

RUN command to find those parameters. No sneaky machine code tricks have to be used; this can all be done from Basic. Once you have the address of the input line from that input buffer pointer (or the hardwired address on the Color Computer), you must step over the tokenized RUN command to find where the parameters start. This is just a matter of scanning for the RUN token (142 on both the Color Computer and Model I/III/4), checking for the colon after it, and then stepping over the REM or apostrophe token. Once you have found the REM statement and skipped past it, you are now pointing directly at the parameters. Then it is a matter of picking these up character-by-character until you hit the end of the input line, which is signified by a byte of 0.

This is what you find in the input buffer on a Model I/III/4 without passing any parameters:

RUN' = 142 58 147 251 0
RUNREM = 142 58 147 0

Notice that RUN' is actually tokenized into an extra byte over the ordinary REM even though it looks shorter when typed in. Notice also that a colon (the number 58) is inserted after the RUN token even though one wasn't typed in; this is the way Basic delimits the RUN command. The number 147 is the tokenized REM, and a 251 is added (heaven knows why) if you used an apostrophe instead of a REM.

Now for a few examples on the Color Computer. The principle is exactly the same; however, on this machine the REM tokens are 130 for REM and 131 for an apostrophe (hex 82 and 83).

RUN' = 142 58 131 0
RUNREM = Syntax Error
RUN:REM = 142 58 130 0
RUN:ONE = 142 58 136 69 0
RUN'ONE = 142 58 131 79 78 69 0

Except for the fact that the Color Computer won't let you get away with RUNREM, the first three lines are as in the Model I/III/4. The fourth example shows what happens when you don't separate the parameters with a REM: the ONE has been tokenized to an ON (the number 136), and a letter E (the number 69). The next line shows O, N, and E intact as the numbers 79, 78 and 69.

Once you have an idea what to look for after the RUN token, you can store any parameters in a long string containing the whole line's worth or you can separate them into substrings by using spaces as delimiters. How you process the parameters is entirely dependent on what you want your program to do. The general idea is that your program can then take its own actions according to which parameters are passed.

This can be a nice shorthand way of making your program take alternative actions. For instance, instead of making it ask such dumb questions as "do you have a line printer," you can pass this as an option along with the RUN command. Of course, to get a really foolproof, watertight version, you should have some action such as asking that question if the parameter wasn't passed or was passed ambiguously.

Listing 1 shows an example for the Model I/III/4 of this very process. It scans for the parameters ONE, TWO,

Listing 1. Parameter-passing on the Model I/III/4.

```
10 LO=PEEK(16551) : HI=PEEK(16552) : IP=HI*256+LO-1
20 GOSUB 2000 ' parse parameters into A$ array
30 IF BT = -1 THEN PRINT"No parameters":GOTO999
40 FOR I = 0 TO PN : PRINTA$(I) : NEXT ' show we found 'em
50 FOR I = 0 TO PN ' for each parameter found
60 A$ = A$(I) : GOSUB 3000 ' print value of parameter
70 NEXT
999 END
1000 BT = PEEK(IP+I) : I = I+1 : RETURN

1099 'This routine scans for the first valid character after the
RUN token. If there are no parameters, BT will be zero.
Otherwise, IP+I will point at the first parameter character.
1100 GOSUB 1000 ' get first character after RUN token
1110 IF BT = 0 THEN RETURN ' no parameters
1120 IF BT = 58 THEN GOSUB 1000 ' step over colon
1130 IF BT = 147 THEN GOSUB 1000 ' step over REM
1140 IF BT = 251 THEN GOSUB 1000 ' step over apostrophe
1150 I = I-1 ' back up pointer as line 1000 bumped it
1160 RETURN

1999 ' This routine parses (scans) the parameter characters,
breaking them up into words each of which goes into an element
of A$(). Space characters serve to delimit these words.
2000 GOSUB1100 ' point to first parameter character (if any)
2010 IF BT = 0 THEN BT = -1 : RETURN ' flag no parameters
2020 GOSUB 1000 ' get parameter character
2030 IF BT = 0 THEN RETURN ' if reached line end
2040 IF CHR$(BT) = " " THEN 2070 ' if got a space delimiter
2050 A$(PN) = A$(PN)+CHR$(BT AND 223) ' to string in uppercase
2060 GOTO2020 ' get next character for this string element
2070 IF PN = 10 THEN RETURN ' don't go past string dimension
2080 PN = PN + 1 ' deal with next parameter string
2090 GOTO 2020 ' loop around

2999 'See if we can match the string passed in A$
3000 IF A$ = "ONE" PRINT 1 :RETURN
3010 IF A$ = "TWO" PRINT 2 :RETURN
3020 IF A$ = "THREE" PRINT 3 : RETURN
3030 PRINT " ?" : RETURN ' got a mystery string
```

Listing 2. Changes required for Color Computer version.

```
10 IP = 733
1130 IF BT = 130 THEN GOSUB 1000 ' step over REM
1140 IF BT = 131 THEN GOSUB 1000 ' step over apostrophe
```

and THREE and simply prints out the corresponding numbers to prove that it really understood. Listing 2 shows the changes needed to run on the Color Computer; the only changes are the input pointer (which is set to 733) and the tokens for REM.

In this program, I decided to parse the parameters into a string array for which I didn't specify a dimension so you could pass a maximum of 11 parameters this way. (Ten being the default dimension for an undeclared array, so we can use elements 0 to 10.)

The program knows it has reached the end of the parameters by checking against a variable PN, which is the number of parameters counted in. Notice that there is also a check in line 2070 for a maximum number of parameters. Without this, it would be possible to crash the program with a dimension error, because the program would just keep scanning for new strings, eventually placing one into an element of the array that wasn't dimensioned. This would be easy to overcome just by dimensioning an array to some maximum number. If you work it out, the maximum number would be the number of characters you could place after the RUN command separated by spaces, which would be four characters for the R, U, N, and apostrophe characters which, on a 255 character logical line length, leaves 251 characters for parameters.

To find the maximum, you must assume the shortest possible parameters that could be input. This would be single characters separated by delimiters such as spaces, leaving you with a maximum of 125 possible parameters. It beats asking 125 questions in the program, but heaven help you if you get one of them wrong.

In practice, most versions of Basic allow only 249 characters from the input prompt so you are left with a maximum of 122. I couldn't foresee many situations in which you would want to deal with more than ten though. Nevertheless, if you want to design a program that allows the direct input of 122 different options from the RUN command line, you now know how to do so.

One interesting parameter that can be passed is a filename. Instead of immediately asking for an input or output filename, your program can scan the RUN command line for that very filename. There are all kinds of uses for this parameter-passing facility—all you need to know is where to look for that input buffer. ■

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CIRCLE 111 ON READER SERVICE CARD

COMMODORE'S PORT

Making a chart of your Commodore 64 character sets/**John Michael Lane**

We all agree that the Commodore 64 offers great graphics. With sprites, programmable characters, bit mapped screens and a variety of multi-color modes, the programmer can choose exactly what he wants.

There is one small problem, however. While the graphics on the screen are terrific, it is often difficult to convey a representation of the characters that compose them without a TV. C64 graphics just don't lend themselves to hardcopy. We can't solve that problem here, but we can tackle one small area—that of programmable characters. The program presented here will print out enlarged images of all characters in a programmed character set. Unfortunately, with a black and white printer, we can't tackle multi-colored character sets.

First, you need a printer that is capable of printing block graphics. Many dot matrix printers have these block characters and most use the same ASCII character numbers for them. Figure 1 shows the block characters and ASCII numbers for a Gemini 10-X printer. Look for a chart in your printer manual displaying all of its character sets.

If your printer has the block characters, chances are that it also has adjustable line spacing. Block images on the Gemini 10-X have only a 6 x 6 dot image. At standard spacing, there is a space between any two lines. With the line spacing adjusted to 6/72 of an inch, printed lines will just touch one another, leaving no space between. On the Gemini 10-X the appropriate line spacing can be set by either of the following sequences:

```
PRINT#4,CHR$(27)+"1"+
    CHR$(12)
PRINT#4,CHR$(27)+"A"+
    CHR$(6)
```

If you have block characters on your printer and can set the appropriate line spacing, you need only one more thing: a printer interface that can pass characters from your computer to your printer without ASCII correction. On the Cardco printer interfaces, this is accomplished by using a secondary address in the OPEN statement. The statement OPEN 4,4,4 will open the printer interface without correction of ASCII data. Without this feature, the printer interface would translate the ASCII values of the block characters (and the printer initialization routines) into standard Commodore 64 graphic characters.

The program presented here will print out enlarged images of all characters in a programmed character set.

While this may seem an intimidating list of requirements, many dot matrix printers offer block characters, and almost all printer interfaces allow you to lock out the ASCII correction.

Creating Character Sets

If you are interested in printing hardcopy images of your programmed character sets, you probably already know how to access that feature of the C64. If you don't, have a look at Figure 2, which provides an overview of the way in which character images are translated from numerical data and vice versa.

In its default mode, the C64 fetches character data from ROM. There are two 256-character sets stored in 4K of ROM. Each character requires eight bytes to store its image. Values in the screen memory act as pointers that direct the Commodore to the appropriate data in ROM to form each character. For example, a pointer value of 26 points to the data for the character Z. The complete list of characters is given in Appendix E of the Commodore 64 User's Guide, Screen Display Codes.

Programmed characters are created by directing the C64 away from data in the character ROMs and toward user created data stored in RAM. Since character data are now stored in RAM, you can create new character patterns.

There have been many articles and books written on using programmed characters, so we need not repeat that information here. If you are interested in programmed characters, you can consult one of those sources or the Programmer's Reference Guide.

Using the Program

This program can be used to print hardcopies of the standard character sets in ROM, of any user-created character set, and of character sets used in programs created by others.

However, this program cannot load or create the character sets, except the ROM character sets. Thus you must rely on your program to create and load the character set data. To load and transfer control to the Patterns program, you must be able to stop the program with the custom character set and return to Basic *without* turning your computer off. This is usually easy to accomplish with programs you have written, but can be difficult or impossible with machine language programs. In the latter case, you can choose one of two approaches.

First, you can just let the program terminate, if it returns to Basic after completion. Then load and run the Patterns program. Second, you can press RUN/STOP or RUN/STOP-RESTORE. You should do this after the program begins to use the custom character set. Some programs disable these keys, so this method cannot be used. If you can return to the READY prompt, however, just load and run the Patterns program. If you know how to reset your computer or have added a reset key, you can also use that method.

Some programs appear to be "hung up" after you press RUN/STOP-RESTORE, but, in reality, are not. If your program switches the 16K memory bank addressed by the Vic-II chip, pressing these keys together will produce a new screen, but pressing them separately will produce no response. If this is the case, try typing RETURN POKE 648,4 RETURN. This will not show on the screen, but may solve the problem.

If programmed characters have

Figure 1. Block characters.

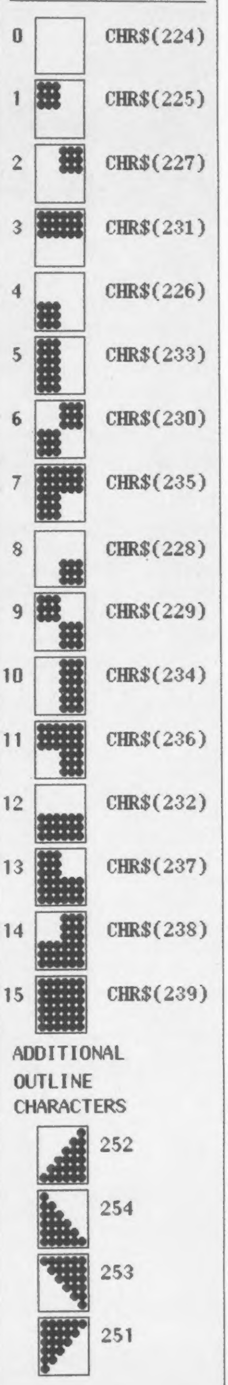
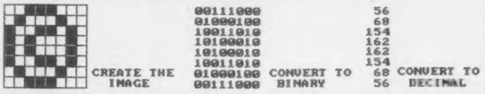


Figure 2. Creating programmed characters.



```
00111000     56
01000100     68
10011010    154
10100010    162
10100010    162
10011010    154
01000100     68
00111000     56
```

LOAD INTO MEMORY *

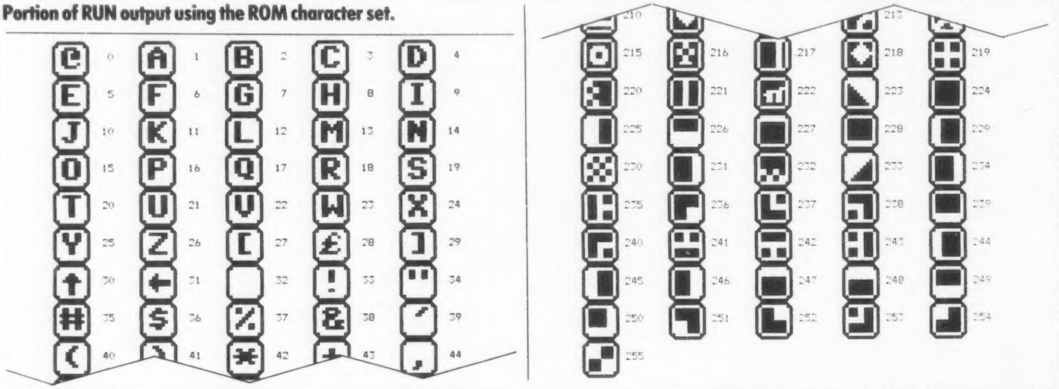
```
100 FOR I=14792 TO 14799
110 READ A:POKE I,A
120 NEXT I
200 DATA 56,68,154,162,162,154,68,56
```

* USING A CHARACTER BASE OF 14, A POINTER OF 50. 14792=1028*14+8*50

Listing 1.

```
50 REM SET SCREEN COLORS
60 ROKE 53280,15:POKE 53281,15:PRINT"[ BLU ]"
100 REM CHARACTER PATTERNS GENERATOR
110 REM LOAD CHR$() NUMBERS FOR BLOCK CHARACTERS
120 DIM P(15)
130 FOR I=0 TO 15
140 READ P(I)
150 NEXT
160 DATA 224,225,227,231,226.233,230,235,228,229.
234,236,232,237,238,239
200 REM GET ESSENTIAL DATA ABOUT CHARACTER DATA L
OCATION
210 PRINT"[ CLR ]"
220 PRINT"DO YOU WANT TO PRINT THE ROM"
230 PRINT"CHARACTER SET (1),"
240 PRINT"OR PRINT A CUSTOM CHARACTER SET (2)"
250 INPUT"ENTER 1 OR 2";R
260 IF R=1 THEN 1050
270 IF R<> 2 THEN 250
300 PRINT"[ CLR ]"
310 PRINT"[ 3 SPC ] YOUR CHARACTER SET SHOULD
ALREADY"
320 PRINT"BE LOADED IN RAM."
330 PRINT"[ 3 SPC ] IF NOT LOAD AND RUN YOUR CUSTOM"
340 PRINT"CHARACTER PROGRAM,"
360 PRINT"AND THEN LOAD AND RESTART THIS PROGRAM"
370 PRINT"[ BLK ]"
380 PRINT"WHICH MEMORY BANK DOES YOUR PROGRAM USE
 FOR GRAPHICS"
390 PRINT TAB(5);"BANK 0:[ 3 SPC ] 0-16K"
400 PRINT TAB(5);"BANK 1:[ 2 SPC ] 16-32K"
410 PRINT TAB(5);"BANK 2:[ 2 SPC ] 32-48K"
420 PRINT TAB(5);"BANK 3:[ 2 SPC ] 48-64K"
430 PRINT
440 PRINT "IF IN DOUBT, ENTER 0"
450 INPUT "YOUR REPLY, PLEASE (0-3)";BANK
460 PRINT"[ CLR ]"
470 PRINT "WHAT IS THE LOCATION OF YOUR CHARACTER"
480 PRINT "SET DATA (0-14:EVEN NO.S ONLY)"
490 INPUT CP
500 INPUT "HOW MANY CHARACTERS TO PRINT";NUMBER
510 INPUT "START AT CHARACTER NUMBER";SCHAR
520 PRINT "AND END AT CHARACTER ";SC+NUMBER-1
530 INPUT"WHAT IS THE NAME OF YOUR SET";NAME$
590 REM OPEN PRINTER WITH NO CORRECTION OF ASCII
DATA - CHECK INTERFACE MANUAL
600 OPEN 4,4,4:REM WORKS WITH CARDCO INTERFACES
610 PRINT"[ CLR ]"
620 PRINT"[ BLU ] ALIGN PAPER IN PRINTER - TOUCH RE
TURN"
630 INPUT R$
650 PRINT#4,CHR$(27)+"A"+CHR$(6);:REM SET LINE SP
ACING TO 6/72 INCH
660 PRINT#4,CHR$(27)+"U"+CHR$(1);:REM SELECT UNID
IRECTIONAL PRINTING
670 PRINT#4,CHR$(27)+"B"+CHR$(2):REM SET 12 CHARA
CTERS/INCH
700 PAGES=INT(NUMBER/90)+1
709 REM PRINT SOME PAGES
710 FOR I=0 TO (PAGES-1)
715 GOSUB 2000
720 LINES=18
730 IF NUMBER-90*(I+1)<=0 THEN LINES=INT((NUMBER-
90*I-1)/5)+1
739 REM PRINT SOME LINES
740 FOR J=0 TO (LINES-1)
750 IMAGES=5
760 IF NUMBER-90*I-5*(J+1)<=0 THEN IMAGES=NUMBER-
90*I-5*J
765 PRINT#4,TAB(10);
770 FOR K=0 TO (IMAGES-1)
779 REM PRINT TOP BORDER
780 PRINT#4,CHR$(252)+CHR$(231)+CHR$(231)+CHR$(23
1)+CHR$(231)+CHR$(254);
790 PRINT#4,"[ 8 SPC ]";
800 NEXT K:PRINT#4
810 FOR Z=0 TO 6 STEP 2:REM FOUR LINES FOR EACH I
MAGE
815 PRINT#4,TAB(10)
820 FOR K=0 TO (IMAGES-1)
830 PRINT#4,CHR$(233);
840 FOR L=7 TO 1 STEP -2:REM USE 'Q' FOR PATTERN
MATCHING/5 CHARACTERS EACH LINE
850 Q=0:REM INTIALIZE 'Q'
860 IF PEEK(16384*BA+1024*CP+720*I+40*J+8*K+8*SC+
Z)AND(2↑L) THEN Q=Q+1
865 IF PEEK(16384*BA+1024*CP+720*I+40*J+8*K+8*SC+
Z)AND(2↑(L-1)) THEN Q=Q+2
870 IF PEEK(16384*BA+1024*CP+720*I+40*J+8*K+8*SC+
Z+1)AND(2↑L) THEN Q=Q+4
880 IF PEEK(16384*BA+1024*CP+720*I+40*J+8*K+8*SC+
Z+1)AND(2↑(L-1)) THEN Q=Q+8
889 REM 'Q' CALCULATED - PRINT CORRESPONDING PATT
ERN P(Q)
890 PRINT#4,CHR$(P(Q));
900 NEXT L
910 PRINT#4,CHR$(234);
915 IF Z=2 THEN PRINT#4.RIGHT$("[ 4 SPC ]"+STR$(90
*I+5*J+K+SC),4);"[ 4 SPC ]";:GOTO 920
918 PRINT#4,"[ 8 SPC ]";
920 NEXT K:PRINT#4,
930 NEXT Z
935 PRINT#4,TAB(10);
940 FOR K=1 TO IMAGES
949 REM PRINT BOTTOM BORDER
950 PRINT#4,CHR$(253)+CHR$(232)+CHR$(232)+CHR$(23
2)+CHR$(232)+CHR$(251);
960 PRINT#4,"[ 8 SPC ]";
970 NEXT K:PRINT#4
980 NEXT J
985 PRINT#4,CHR$(12):REM EXECUTE FORM FEED
990 NEXT I
1000 CLOSE 4
1010 END
1049 REM THIS SUBROUTINE TRANSFERS STANDARD CHARA
CTER DATA FROM ROM TO RAM
1050 PRINT"[ CLR ]"
1060 PRINT"UPPER CASE/GRAPHICS SET = 1"
1070 PRINT"UPPER CASE/LOWER CASE SET = 2"
1080 INPUT"ENTER YOUR CHOICE OF CHARACTER SETS";CS
1100 PRINT"[ CLR ]"
1110 PRINT"NOW SWITCHING CHARACTER SET DATA FROM"
1120 PRINT"ROM TO RAM - ([ R ON ]ABOUT[ R OFF ] 50
 [ R ON ]SECONDS[ R OFF ])"
1130 REM SWITCH IN RAM CHARACTER SET
1140 POKE 53272,(PEEK(53272) AND 240)+12
1150 REM DISABLE INTERRUPTS
1160 POKE 56334, PEEK(56334) AND 254
1170 REM SWITCH CHARACTER ROM INTO MEMORY
1180 POKE 1, PEEK(1) AND 251
1190 REM RELOCATE CHARACTER DATA
1200 FOR I=0 TO 2047
1210 POKE 12288+I,PEEK(53248+2048*(CS-1)+I)
1220 NEXT I
1230 POKE 1, PEEK(1) OR 4
1240 POKE 56334. PEEK(56334) OR 1
1250 BANK=0:CP=12:GOTO 500
1999 REM THIS SUBROUTINE PRINTS THE PAGE HEADER
2000 FOR X=1 TO 3:PRINT#4,:NEXT
2003 PRINT#4,NAME$
2005 PRINT#4,
2010 PRINT#4,"COMMODORE 64 CHARACTER SET[ 13 SPC ]
PAGE";I+1;"OF";PAGE
2015 PRINT#4,
2020 RETURN
```

Portion of RUN output using the ROM character set.



been selected, you need two pieces of information to find them.

First, you need to know which bank the Vic-II chip is addressing. The video chip in the Commodore 64 can look at only 16K of memory at one time. In most cases, the chip is addressing the first 16K of memory, which is the default mode. If you are working with a really long program, the first 16K of RAM becomes full of program data and leaves no room for character data. In such a case, you must switch to another bank to squeeze in the character data. If all this sounds like Greek to you, you are undoubtedly using bank zero.

Second, you need to know the location of the character set within that 16K block of RAM. The C64 uses a pointer stored in register 53272 to point the way toward the character set in RAM. If you can create custom characters, you know what this value is. If not, look over the program listing for a statement that looks like:

```
POKE 53272,(PEEK(53272)
    AND 240)+12
```

or:

```
POKE 53272,(PEEK(53272)
    AND 240) OR 12
```

Sometimes the value 53272 is represented as a variable, such as:

```
10 V=53248
20 POKE V+24,(PEEK(V+24))
    AND 240)+12
```

In all these cases 12 is the value of the pointer for which you are looking. If the value is odd, simply reduce it by one.

Sometimes you can find the value of the 16K bank and the character set pointer by stopping the operation of the program with the RUN/STOP key. If you can do this successfully, typing:

```
PRINT PEEK(53272) AND 15
```

will yield the value of the character set pointer, and:

```
PRINT 3-PEEK(56578) AND 3
```

will yield the value of the 16K bank addressed by the Vic-II chip.

The rest of the program is simple. Just specify how many of the characters you want printed and the number of the character with which you want to start. (The first character in the character set is character 0.) This program is not terribly fast; it will take about 45 minutes to print all 256 characters in a set. The program automatically formats your output and numbers the pages.

You may find that your printer has block characters, but the CHR$( ) numbers do not match those in this article. In this case simply substitute your values in the DATA statement on line 160. Enter the numbers in the same order as the block characters in Figure 1. If your printer or interface requires different command sequences, insert those sequences where appropriate. All interface and printer commands are labeled with REM statements.

Understanding the Program

The program is fairly well documented with REM statements, so you may already have figured out how it works. The main idea is rather simple. You take the 8 x 8 pixel character image and divide it into 16 2 x 2 pixel images. The block characters on the printer offer all possible combinations of 2 x 2 images. It is not difficult to figure out how to print the block characters so that they form one large image; the problem is how to select the correct block character to match the character image in memory.

At the time this program was written, I had just finished working on a short tutorial on binary numbers. As I wondered "How can I match the RAM pattern with the corresponding block character?" binary numbers leapt out at me.

Imagine that each block character is a binary number. The bit sequence is shown in Figure 3. If you evaluate the block character according to this sequence, each block character has a unique numeric value ranging from 0 to 15. You load the ASCII value of each character into the P array [P(I)] in the order of the value of its binary image. If you want to print the character that has the binary image of 12, just issue the instruction:

```
PRINT CHR$(P(12))
```

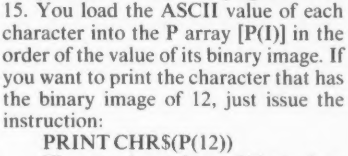
The actual matching of block characters is done in lines 840 through 900. The variable Q is used in the calculation and is incremented by the appropriate binary value (1, 2, 4, or 8) if the corresponding bit in RAM is set to 1 (lines 860 through 880). The statement:

```
PRINT#4, CHR$(P(Q));
```

in line 890 prints the correct block character.

The Commodore 64 and Commo-

Figure 3. Bit patterns for block characters.



dore printers offer block graphics as well, although it is necessary to use reverse video to get them all. I find it convenient to add 256 to the ASCII value of those characters that require a reversed image. Then, when printing the characters, the following sequence:

```
900 IF P(Q) > 255 THEN
      PRINT CHR$(18)
      + CHR$(P(Q)-256)
      + CHR$(146):
      GOTO 920
910 PRINT CHR$(P(Q))
```

selects the right character. (CHR$(18) and CHR$(146) are REVERSE ON and REVERSE OFF.)

It would make the programming task a little easier if you printed the characters one at a time. It would be more useful, however, if you could print more than one character in a row. This program prints five characters in a row. This means that you must print the top portion of one character, the top portion of another character, etc., and then proceed to the next portion. When you are analyzing the program, note carefully the FOR/NEXT loop nesting which makes this possible. I have also included a border around the character images, for a more finished appearance.

To the extent possible, I have used full variable names in the program (BANK, NUMBER, PAGES, LINES, etc.) While the Commodore 64 allows variable names of any length, it looks only at the first two letters of any variable. Thus, BANK is really BA. I have used the full names to add clarity to the program. In some lines, however, I revert to the two character names to fit an equation on the 80-character line, (as in lines 860 through 880).

Additional Applications

If you understand the technique for pattern matching, block characters offer several other graphics applications. The same technique can be used on sprites to print hardcopies of two-color sprite images. Simply divide the 24 x 21 pixel image into 2 x 2 block characters. You will have to add a blank line on the bottom to make it come out properly.

If you are really ambitious you can even tackle a screen dump of a portion of a bit-mapped screen using block characters. Using 12 pitch, a standard sheet of paper can hold a 192 x 264 pixel image running lengthwise. ■

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CIRCLE 106 ON READER SERVICE CARD

IBM IMAGES

The view from the top/Will Fastie

I have now had a chance to play with two new environments for the PC: IBM's own TopView and Digital Research's GEM. Let's get the cards on the table right away: I'm not crazy about either of them. In fact, I can't figure out why I would want either of them.

One step at a time. Let's first define the term "environment." Used in this context, the environment is the way in which the operating system presents itself and its functions to the user. Using DOS as an example, a user types the command COPY to make a duplicate of one file somewhere else. In the DOS environment, one generally types a command from the keyboard along with further information the system needs to perform the function. Sometimes the system will ask questions, which also must be answered by typing at the keyboard.

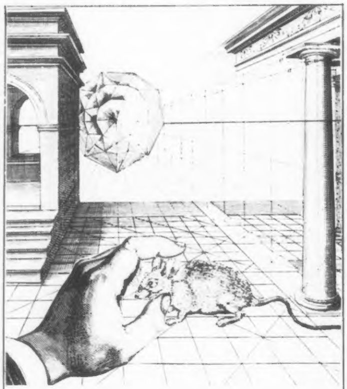
The environment also includes a programmer's interface, a method by which system functions can be invoked under program control. Because I try to write this column from the user's point of view, I will mention this only in passing.

TopView and GEM are programs (*not* operating systems) that run in the DOS environment and extend it so significantly that the environment is radically different. (I thus refer to TopView and GEM as environments unto themselves.) Generally, commands are not typed. Instead, both environments require the user to point, and both manage the screen display in a manner that has come to be known as windowing. Beyond that, the two programs are dramatically different.

GEM

To begin with, GEM requires both a graphics display (the IBM Color/Graphics adapter or equivalent is okay, as are the Hercules card and the IBM Enhanced Graphics Adapter) and a mouse (the Microsoft interface is supported). When started, its screen display very much resembles a Macintosh and much of its method of operation is the same as Mac.

Once running, GEM displays its main screen, which initially includes only icons for the disk drives and some selections from the menu bar at the top. Menus are pulled down by clicking on the menu bar, and operations are selected from those menus. Just about everything can be done by pointing, clicking, and, in some cases, dragging. The first operation most users will probably select is OPENing one of the disk icons, which causes the contents of the disk to be displayed in a new window in icon form. The predefined GEM icons allow regular files and directories to be distinguished; executable programs can be distinguished only after the user has "taught" GEM what they are.



Many operations are simple in GEM. To run a program, one need only click on its icon and it will begin operation.

Many operations are simple in GEM. To run a program, one need only click on its icon and it will begin operation. Other operations are simple in concept but tedious in execution. For example, copying a file involves selecting the file to be copied by pointing at it and then dragging a copy of it to a disk or directory icon. That's simple to say, but it gets old after a while. One very nice feature of the GEM copy operation is that multiple files can be marked and then copied to the same place in a single drag. It is something I often wish I could do in DOS (the copy function in a package called *Direc-Tree* works this way).

COPY is a good example, because it is simple. It is equally simple in DOS, however, and that is where I have the biggest problem with GEM. If it is not simpler than DOS, why on earth would I want to use it? Other GEM functions are harder and more tedious than COPY, so I found it quite annoying to work in the environment.

One reason we are all so interested in new environments is the expectation that concurrency, that is, the ability to run more than one program at a time, will be included. GEM does allow multiple windows to be open with programs operating, but only the program in the currently active window actually runs. Whenever you open a new window, the program in the previous window is suspended. So GEM is not concurrent.

I do not want to talk about other programs included with GEM, such as the calculator, because it is more important to consider first how the environment will support the programs you already have rather than how neat the environment's own programs are. I did not have any problems running any programs under GEM, except for *GEM Draw*, and this leads me to a severe criticism of the product. The documentation is atrocious.

Here's the rub. *GEM Draw* is a separate program, individually packaged and documented. *Nowhere* in that document is described the process by which the program is installed in the GEM environment. And yes, installation *is* required. I had read the main GEM book completely through, and it still took me about 20 minutes to figure it out. I finally got *Draw* installed so I could get it started, but then it complained about the absence of its font files. Back to the books. No mention of font files, no mention of error messages. Back to the disk. Nothing looked like or was named as a font file. Finally, I just guessed and managed to get the required files in the right spot. Totally unacceptable, especially for a product supposedly designed for the end-user.

GEM does have some virtues. It is very pretty, and it runs quite well—even on a PC. It is even prettier and quicker on my AT with the EGA. And, as with the Mac, operation of the system is mostly intuitive, with some exceptions.

TopView

IBM's program is, at once, both more and less than GEM. It is more because it is concurrent; it is less because it has extremely limited support for graphics. That is also one of its virtues, because it will run on a system with a monochrome display and can be used (albeit slowly) from the keyboard, without a mouse.

I can't think of much else to say that's nice. As with GEM, I had a pretty terrible time with TopView, but this time it was the fault of the program itself, not the documentation. Three things turned me off to TopView.

> **As with GEM, I had a pretty terrible time with TopView.**

First, its support for standard DOS functions is abysmal. Only five (5, as in 1-2-3-4-5) DOS functions are on the DOS services menu. All other DOS commands must be typed in a specially provided window. But wait! Not *all* DOS functions are supported! About 20 are listed, and TopView prohibits others that it does not know about. I had no such trouble with GEM; Microsoft Windows (pre-release version) does not appear to be so handicapped. Worse, TopView will run in any version of DOS but only knows about things up to DOS 2.1. Egad. One would hope for transparency.

Second, TopView steadfastly refused to run Turbo Pascal Version 3.0, no matter what set of facts I gave it. When TopView is told about a new executable program, it asks only three simple questions and assumes worst-case things for about a dozen others. A facility that allows more specific answers to be given is provided. As I say, nothing worked. TopView and the computer still worked, but Turbo seemed to become completely stunned before it even got its first word out. Maybe Turbo is way out of line, but I could find no information in the TopView manual to help me out. I am now in the process of working through IBM for an answer, but my hopes are not high.

Finally, TopView ran one of my own programs incorrectly. I have written a version of David Mannering's famous program *Air Traffic Controller*. It is written in C, and *it absolutely, positively, obeys all DOS and BIOS rules*! When the program runs, it displays a radar map; just after the first keystroke, the map is scrolled up by one line. That is, it is scrolled by some unknown force: *my* program don't have no such code, and she work fine in DOS! Egad again.

So my opinion of TopView is not very high. Neither, apparently, is IBM's: the program is being offered free with certain PC system configurations. If it were good, we would all be beating a path to IBM's door. As it is, IBM may have to beat us to make us take it.

Two other points about TopView deserve mention. There is a programmer's toolkit for TopView, and I have talked to a few software developers who are using the environment for its concurrency. Each has said that it has what they need and in particular is saving them development time because of the windowing support. I cannot comment personally, but I pass on the information. The review of TopView to appear in *PC Tech Journal* will include the toolkit, and I'll ask that reviewer to write a few words about it for this space in the near future. The other thing is that TopView does impose some overhead, and programs run a little slower. This is the case with most concurrent environments, so it's not a fatal flaw. Better machines, such as the AT, tend to mask such overhead.

The Bottom Line

I used GEM and Topview on my system at home for about ten hours each. I want you to know this: it was a sacrifice. I did it for you. I gritted my teeth the whole time. Don't ask me to do it again. ■

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LEISURE TEASERS

At The Limit

In four Basic statements write a program that will find the sum of the terms in the series: 1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6 . . . Second, find the sum of the terms in the series: 1 – 1/2 + 1/3 – 1/4 + 1/5 – 1/6 . . .

Groovy

The diameters of an LP record and an optical video disc are both the same, 12". On a LP, the unused center has a diameter of 4" and the outside edge is 0.4" wide. If there are 250 grooves to the inch, how far does the stylus move during the playing of a record (feet and inches)? If it revolves at 33.33 rpm, how much music (minutes and seconds) is on the record?

If an optical laser disc contains 54,000 frames on a 12" disc (one frame per revolution), how much distance does the laser scan during a play of the disc? If such a disc has a playing time of 30 minutes (1/30 sec per frame), how fast is it rotating?

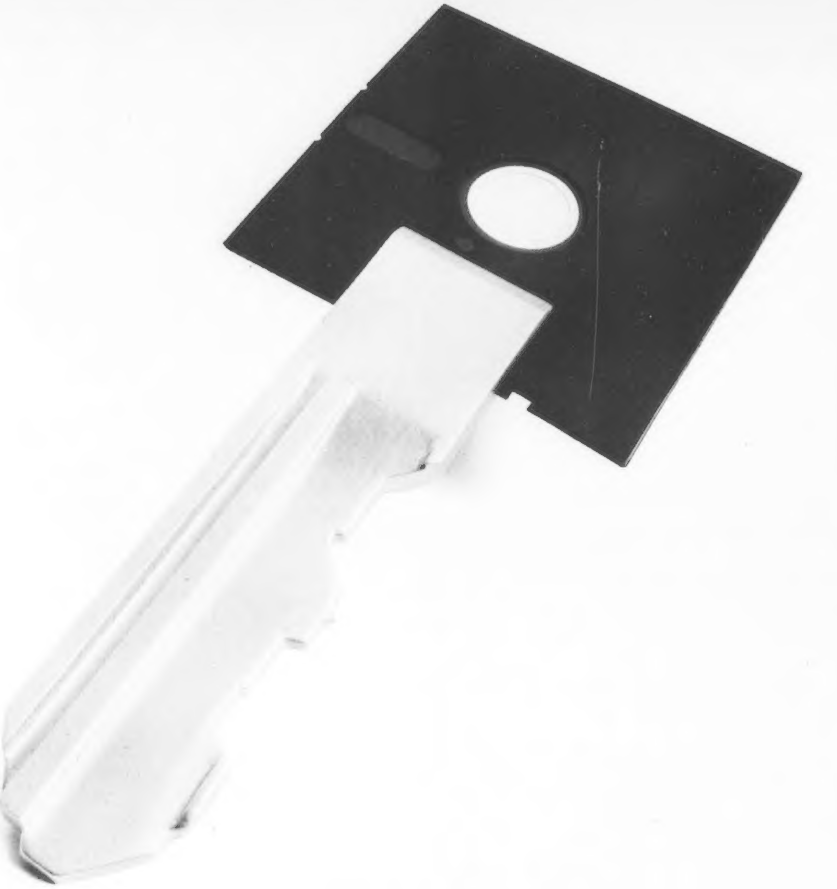
In The Stable

Smith, a former math teacher turned horse trainer, told his wife, "I just came from the stable where the number of heads and arms was the same as the number of legs and tails." What is the smallest number of horses and riders that could have been in the stable?

Not Prime

An integer N is called prime if it is greater than 1 and if its only exact divisors (factors) are 1 and N. Your problem is to write a computer program that will determine the smallest positive integer M such that $K = 7 * 10 + 1$ is not prime. The program should identify M, K, and the second factor of K. (Thanks to Richard Andree of the University of Oklahoma.)

Answers on page 116.



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CIRCLE 125 ON READER SERVICE CARD

OUTPOST: ATARI

Report from CES, with the emphasis on CD-ROM

Sheldon Leemon

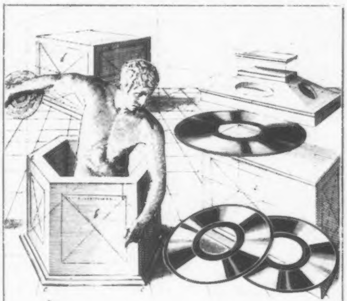
The annual summer Consumer Electronics Show has traditionally been the site of a flurry of new product announcements, but careful observers know the difficulty in sorting the products that will really turn up on dealer's shelves in time for Christmas from those that will be just a faded memory come next Groundhog's day. Even a relative newcomer to Atari can take heed from the example of the 65XE, the 65XEP, the 130ST, the 7800 game machine, and the 1450XL. But real veterans remember that the history of Atari vaporware stretches clear back to the 815 dual disk drive, which we were told in 1981 was "due in the third quarter" (though in all fairness, the year wasn't specified).

Now You See It . . .

Since our Fuji friends have been replaced by J. Tramiel and Sons, the pace of now-you-see-it, now-you-don't has picked up considerably, beginning with the controversy over whether Atari was even going to attend this year's CES. First came the word that they had withdrawn, leading to a wide range of speculation. Did Atari want to change its image as a consumer (read: "games") company? Was the new ST line in trouble? Or did the cost-conscious Mr. Tramiel just want to save himself half-a-million bucks and book his orders from the comfort of a Chicago hotel suite? At the last minute Atari announced that it was back in the show, leading to more speculation. Was J.T. just trying to get a bargain rate for exhibit space by threatening a no-show? Did he do it to throw his competitors off guard by playing possum?

Whatever the reason, Atari did show up at CES, though its exhibit was a mere shadow of its former self. Instead of a huge display area with row after row of 2600 game machines, each showing a different new video game, the new Atari was stuck in a 20 by 20 meeting room, containing one 2600 machine, one 5200, a couple of 130XEs, a 520ST, and a 260STD. A 260STD? Of course! What would a CES be without another Atari mutant to show off? The 260 was said to be the prototype of the mass market version of the ST line. Those of you following Atari's marketing plans will remember that the 520ST is to be sold by computer specialty retailers only, in a bundled system including monitor and disk drive, for $800.

But while specialty stores can offer service and support, they can't order 50,000 pieces at a time as K-Mart can. The 260ST was created to pique the interest of the mass merchants, who so far have been less than eager to get involved with the ST line. The model shown, the 260STD, has 256K RAM, the GEM operating system in ROM, and a built-in 3.5" disk drive, and fits in a keyboard unit small enough to stock on dealers shelves. The projected price of this unit is $500 ($400 without the disk drive).



Atari gave a demonstration at CES of one of the most intriguing peripherals shown in many a year.

Room Per ROM

This, of course, stirs up the old GEM-on-ROM controversy. At first, Atari announced that the GEM OS would appear in ROM, freeing up nearly the whole 512K of RAM for applications. As the release date of the computer approached, however, Atari announced that the first units would have GEM on disk (because it had not been completely debugged, and because the current version could not fit in 192K of ROM). This reduced the usable RAM in the 520 by over 200K. Then, Atari officials stated that GEM might *never* be in ROM on the 520—that might be left to yet another mode. If that was the case, though, the 260ST with GEM on ROM would have almost as much free RAM as the 520ST with a disk-based GEM (so much for product differentiation). This controversy appears to have been laid to rest, at least for the moment, by Sam Tramiel's announcement that Atari will try to have GEM on ROM by the fall, that every 520ST will include sockets for those ROMs, and that 520 owners will be able to purchase the GEM ROMs when available for a "nominal fee."

CD-ROM for Atari

Atari also gave a demonstration at CES of one of the most intriguing peripherals shown in many a year. Elsewhere in this issue, you will find a discussion of the compact audio disk that looks like a teeny silver 45 record and plays an hour of music per side with incredible fidelity. These discs can be used to store incredible amounts of computer data. Atari, in conjunction with a company called Activenture, is developing a device known as a CD ROM. Activenture's vice president of engineering, Tom Rollander, was at the Atari booth demonstrating a prototype model of a disc player that was hooked up to a 520ST. Using the computer, he was able to access all of the information contained in a 20-volume encyclopedia that was stored on part of a single disc.

In fact, the text of the encyclopedia and a special index took up only a quarter of the disk space, leaving room for 3500 full-screen, high-resolution illustrations to be added later. As Mr. Rollander explained, the easiest way to increase the storage density of a magnetic disk is to make the head that reads the information smaller. The "read head" on a CD is a beam of laser light,

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OUTPOST: ATARI

and you can't get much smaller than that. As a result, a single disc can hold 500Mb of data. To bring that staggering figure down to something that an 810 owner can comprehend, that is the equivalent of about 5932 single-density disks. Moreover, since a laser disc is not a magnetic medium, you don't have to record every single byte of data sequentially with a magnetic head. Instead, the whole disc is stamped out at one pass, like an old vinyl record. In volume, the cost of reproducing a single disc that contained every piece of Atari software ever written would be about 75 cents.

With a base of information this vast, the crucial question is how quickly a particular bit of data can be located. With the system demonstrated by Atari, the answer is very fast indeed, due to a special indexing technique. Using large mainframes, Activenture located every unique word in the encyclopedia and formed a pointer to the location of that word within the text. The mainframe then sorted each word and its pointers alphabetically. The result is 60Mb of index, pointing into 58Mb of encyclopedia text. Because the index is in alphabetical order, finding any given reference is a matter of a simple binary search.

Using this technique, Rollander was able to find every reference to the word *toothache* in the entire encyclopedia in less than three seconds.

Searches of phrases involving more than a single word took only a few seconds longer. The software demonstrated allows the user to browse through the whole encyclopedia, easily moving forward or back by line, paragraph, page, article, subheading, or volume. In addition, it allows the user to search for a word or phrase by article title, text, or bibliography, and to look for words or parts of words that are next to each other, within a certain number of words of each other, or in the same paragraph or article.

Although the system shown looked fairly experimental, Atari officials stated that it might be available as early as this fall. And though similar CD ROM players have been selling in the range of $2000, Atari appears to believe that they may be able to market one for about $500. Even if this is just a case of misplaced optimism, CD ROM technology is something to keep your eye on.

Encouraging Signs

Support for Atari computers from third parties has been soft recently, but there were some encouraging signs at the show. Batteries Included, traditionally a Commodore-oriented outfit, has come up with a beautiful version of their *Paperclip* word processor, geared specifically to the Atari. And while others were waiting for Atari to come out with its promised 80-column card/monitor, BI has forged ahead with an 80-column adapter in the form of a cartridge that plugs into the XL or XE, making use of the parallel bus. The prototype they displayed was about the size of a normal game cart, and worked like a champ. This product should be available later in the year, at a cost of $79.95 ("80 columns for 80 bucks" is their motto), and efforts are under way to support the hardware with revisions of *Hometerm* and *Paperclip*, as well as with cooperative ventures with other software houses.

Even at the Commodore booth, I saw signs of hope. A company called Digital Vision was showing a video digitizer system on the Commodore 64. This compact unit will sell for $130. It takes composite video from any source (such as a camera or VCR) and converts it to a digitized computer display. "Is it available for any other computers," I asked? "Yes, it should be ready for the Atari in about two weeks" came the reply. ■

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LEISURE TEASERS

Questions on page 113.

At The Limit: As you probably found out if you made several runs summing a different number of terms, the first series does not converge. The sum of 100 terms is 5.1874; of 1000 terms, 7.4855; of 10,000 terms, 9.7876; of 100,000 terms, 12.091. Each order of magnitude of terms adds about 2.3 to the total, so, in fact, the total eventually approaches infinity—although extremely slowly. On the other hand, the second series converges to approximately 0.69315.

Groovy: LP: 1790 feet, 8.5 inches. 27 minutes. Videodisc: 214,884 feet, 10.8 inches (Approximately 41 miles!), 1800 rpm.

In The Stable: 1 horse and 4 riders. (If you interpreted the word "horses" in the original question to mean more than one horse, the answer is then 2 horses and 8 riders.)

Not Prime: M = 6, K = 7000001, Factor = 197.

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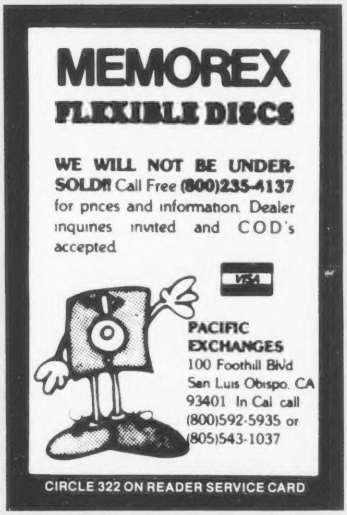

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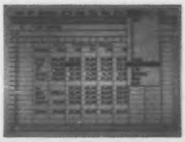

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